

Comments on Volume 1 - Chapters 5,7, and 8

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Sent: Monday, November 18, 2013 6:10 PM

To: DWR CWP Comments

Attachments: Vol1_Ch05_ManagingUncertain.pdf (2 MB) ; Vol1_Ch07_Financing.pdf (438 KB) ;
Vol1_Ch08_Roadmap-For-Action.pdf (717 KB)

Here are the Santa Clara Valley Water District's comments on the California Water Plan Update 2013 Chapters 5, 7, and 8.



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Chapter 5. Managing an Uncertain Future

About This Chapter

Chapter 5, “Managing an Uncertain Future,” emphasizes the need for decision-makers, water and resource managers, and land use planners to use a range of considerations in planning for California’s water future in the face of many uncertainties and risks. It provides examples of uncertainties and discusses the need to assess risks in planning for actions with more sustainable outcomes. An approach is presented for evaluating resource management strategies for robustness by using multiple future scenarios. Water management vulnerabilities identified during preparation of *California Water Plan Update 2013* (Update 2013) are presented. A framework is provided to measure the sustainability of water management policies and projects. This chapter describes the following topics:

- Recognizing and Planning for Risk and Uncertainty.
- Water Scenarios 2050: Possible Futures.
- Managing for Sustainability.
- Summary.

Recognizing and Planning for Risk and Uncertainty

Overview

California Water Plan Update 2009 (Update 2009) included a framework for improving water reliability through two initiatives. The first initiative places emphasis on integrated regional water management (IRWM) to make better use of local water sources by integrating multiple water and related resources, such as water quality, local and imported water supplies, watershed protection, wastewater treatment and water recycling, and protection of local ecosystems. The second initiative places emphasis on maintaining and improving statewide water management systems. These two initiatives form the foundation of the *Update 2013 strategic plan to secure reliable and clean water supplies through 2050*. The California Water Plan (CWP) acknowledges that planning for the future is uncertain and that change will continue to occur (see Box 5-1). Update 2013 builds on three key considerations in the planning approach for future management of regional and statewide water resources. The planning approach should (1) recognize and reduce uncertainties inherent in the system, (2) define and assess the risks that can hamper successful system management and select management practices that reduce the risks to acceptable levels, and (3) keep an eye toward approaches that help implement and maintain water and flood management systems that have more sustainable outcomes.

PLACEHOLDER Box 5-1 Uncertainty, Risk, and Sustainability

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of the chapter.]

Traditional Planning Approach — The Past is a Model for the Future

Water managers recognize the variable nature of waterflow in California's streams and rivers during wet and dry periods spanning from seasons to multiple years. Having too little water or too much water — droughts or floods — were often primary reasons that Californians built early water projects. Early in California's water development history, personal observations, and experience were often used to help size water facilities because of the limited availability of recorded data.

A system to record waterflow conditions over time gradually improved information available to water managers. However, the main assumption governing water planning and management for much of California's history has been that past records were a good indication of the frequency, duration, and severity of future floods and droughts, and these records were used as predictors of potential future conditions. In addition, historical records were generally used to establish trends, such as population growth, which were assumed to continue into the future.

This static view of the range of possible future conditions based on past records worked fairly well when the demands on the resources were considerably lower than now. Early designers of water facilities may have understood the variability of storm events and the range of streamflows that could occur and the likelihood that a reservoir would refill in a given year, but generally they did not fully understand or consider the interrelationships among ecosystem functions, flood management, water availability, water use, and water quality.

The past approach to flood planning focused on flood damage reduction and public safety. Projects were designed to control and capture flood flows by using facilities such as dams, levee systems, bypasses, and channel enlargements. Although these projects provided significant flood protection benefits, some of these early structural projects caused unintended consequences of higher peak flows, conflicts with environmental resources, and increased flood risks. These experiences have prompted flood planners to look more comprehensively at flood systems to gain a better understanding of floodplains, related water supply, and environmental systems to provide multiple benefits.

In addition, risks posed by earthquakes, extreme floods, and extreme droughts were generally underestimated. Without a complete acknowledgment of the uncertainties inherent in the system and the risks that the system actually faced, management was relatively simple compared with today's standards. Conditions appeared more certain and less risky than they actually were, and water managers were more focused on meeting shorter term objectives. Although understanding the past is still an important part of managing for the future, it is becoming increasingly apparent that continued management under this traditional approach will not provide for sustainable water resources into the future.

New Planning Approach — Anticipate Change

Today, as part of IRWM and integrated flood management, California's water and resource managers must recognize that conditions are changing and will continue to change. Traditional approaches for predicting the future based solely on projecting past trends will no longer work. Today, there is better recognition that strategies for future water management must be dynamic, adaptive, and durable. In addition, the strategies must be comprehensive and integrate physical, biological, and social sciences, as well as consider risk and uncertainty.

California’s water management system is large and complex with decentralized water governance that requires a great deal of cooperation and collaboration among decision-makers at the State, federal, tribal, regional, and local level. California lacks a common analytical framework and approach to understand and manage the system, especially when management actions may compete for the same resources. Water managers must make sound investments that balance risk with reward, given today’s uncertainties and those that may occur in the future. Update 2013 works to strengthen alignment between water managers while considering investment in innovation and infrastructure with multiple benefits.

As described in more detail in Chapter 6, “Integrated Data and Analysis: Informed and Transparent Decision Making,” the CWP promotes ways to develop a common approach for data standards and for understanding, evaluating, and improving regional and statewide water management systems, and for common ways to evaluate and select from alternative management strategies and projects. DWR has initiated work on the Water Planning Information Exchange (Water PIE). This system for accessing and sharing data across existing networked databases will use Web services and Geographic Information System (GIS) software to improve analytical capabilities, develop timely surveys of statewide land use and water use, and estimates of future implementation of resource management strategies. Ultimately, Water PIE will build on, complement, and connect several existing data-sharing sites managed by DWR, including the Water Data Library, California Data Exchange Center, and the California Irrigation Management Information System.

Update 2013 acknowledges that planning for the future is uncertain and that change will continue to occur. It is not possible to know for certain how population growth, land use decisions, water demand patterns, environmental conditions, climate, and many other factors that affect water use, supply, and flood management may change by 2050. To anticipate change, water management and planning for the future needs to consider and quantify uncertainty, risk, and sustainability.

- **Uncertainty.** How water demands will change in the future, how ecosystem health will respond to human use of water resources, what disasters may disrupt the water system, and how climate change may affect water availability, water use, water quality, flooding, and the ecosystem are just a few uncertainties that must be considered. The goal is to anticipate and reduce future uncertainties, and to develop water management strategies that will perform well despite uncertainty about the future.

Uncertainties will never be eliminated, but better data collection and management and improved analytical tools will allow water and resource managers to better understand risks within the system. Many water agencies in California have begun incorporating climate change information into their operation and planning process to reduce uncertainty of how climate may affect California’s water resources in the future. Additional efforts are needed to develop the accurate climate data needed to reduce uncertainty and risk in California water management in the future. To read more about the development of DWR’s Climate Science program, see in Volume 4, *Reference Guide*, the article “The State of Climate Change Science for Water Resources Operation, Planning, and Management,” and visit <http://www.water.ca.gov/climatechange>.

- **Risks.** Uncertainties about future conditions contribute to water-related risks. Each future event has a certain, but unknown, chance of occurring and a set of consequences should it occur. Combining the likelihoods with consequences yields estimates of risk. For example, a chance

of a levee failure with a certain-size flood event can be estimated with associated economic and human consequences. Likewise, one can estimate the likelihood of a drought of a specific severity and combine this with estimates of the consequences.

By reducing the uncertainties described above, the “true” risks can be reduced. State government and other entities are performing risk assessments that can be used in future planning to balance risk with reward when implementing new management actions. Risk assessments are also a way to quantitatively consider the uncertainties that relate to events of interest, such as the performance of levees, the consequences of flooding, and the impact of events on the environment. More information on these risk assessments can be found later in this chapter.

- **Sustainability.** Given the uncertainties and risks in the water system, one set of management strategies may provide for more sustainable water supply, flood management, and ecosystems than another set of management strategies. Water management must be dynamic, adaptive, and durable. As described later in this chapter, DWR has developed a draft framework for quantifying indicators of water sustainability and has begun testing the indicators in regional pilot studies.

Recognizing and Reducing Uncertainty

There are two broad types of uncertainty:

1. The first type of uncertainty comes from the inherent randomness of events in nature, such as the occurrence of an earthquake or a flood. However, additional data may allow better quantification of this uncertainty.
2. The second type of uncertainty can be attributed to lack of knowledge or scientific understanding. In principle, this uncertainty can be reduced with improved knowledge that comes from collection of additional information.

Although it is not necessary to categorize uncertainty for Update 2013 into these two types of uncertainty, it is important to consider these while improving data collection and analytical tools.

California’s water and resource managers must deal with a broad range of uncertainty. Uncertainty is inherent in the existing system and in all changes that may occur in the future. For example, although water managers can be certain that the flows in California’s rivers will be different next year compared with this year, they do not know the exact magnitude or timing of those changes. The threat of a chemical spill that may disrupt water diversion presents uncertainty. Future protections for endangered species may require modifications in water operation procedures that are unknown today. Scientists are trying to understand the reasons for the pelagic fish decline in the Sacramento-San Joaquin Delta (Delta), the condition of levees throughout the state, and the extent of groundwater recharge and overdraft, to name just a few of the uncertainties that need to be addressed in planning for the future.

For the purposes of considering potential changes and their inherent uncertainties, it is useful to consider and estimate how change may occur, gradual changes over the long term and more rapid or sudden changes over the short term. Gradual changes can include such factors as variation in population by region, shifts in the types and amount of crops grown in an area, or changes in precipitation patterns or sea level rise. Sudden changes can include episodic events, such as earthquakes, floods, droughts,

equipment failures, chemical spills, or intentional acts of destruction. The nature of these changes, the uncertainties about their occurrence, and their potential impacts on water management systems can greatly influence the response to the changes. Box 5-2 shows some sources of future change and uncertainty.

PLACEHOLDER Box 5-2 Sources of Future Change and Uncertainty

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of the chapter.]

With improved understanding of uncertainties, risks facing future operation of the system can be better assessed. Most risks originate from such hazards as floods, earthquakes, and droughts. But risks can also result from other issues, such as water demands growing faster than anticipated, salt water intrusion, or land subsidence caused by groundwater overdraft. Risk can be defined as the probability that a range of undesirable events will occur, which is usually linked with a description of the corresponding consequences of those events. Box 5-3 describes how risk management is an integral part of flood management. A range of tools is available for assessing and accounting for risk (see in Volume 4, *Reference Guide*, the article “Accounting for Risk”).

PLACEHOLDER Box 5-3 Managing Floods vs. Managing Flood Risk

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of the chapter.]

There is no way of predicting the future with absolute certainty, but scenarios of possible future conditions can be constructed. Update 2013 considers many alternative, plausible, yet very different future scenarios as a way to consider uncertainty and risk and improve resource sustainability. For example, three alternative population growth rates and three alternative assumptions about future land-use development density are considered, thus yielding nine alternative growth scenarios. Many alternative scenarios of future climate are considered in order to represent extended droughts and climate change. The concept is not to plan for any one given future, but to identify strategies that are robust across many scenarios. Certain combinations of management strategies may prove to be robust regardless of the future conditions. This is especially true if the strategies have a degree of adaptability to differing conditions that may develop. A general description of the scenarios can be found later in this chapter.

Water Scenarios 2050: Possible Futures

Since *California Water Plan Update 2005* (Update 2005), the CWP has used the concept of multiple future scenarios to capture a broad range of uncertain factors that affect water management, but over which water managers have little control. Scenarios are used to test the robustness of strategies by evaluating how well strategies perform across a wide range of possible future conditions. The CWP organizes scenarios around themes of population growth, land use patterns, and climate change. Growth scenarios characterize a range of uncertainty surrounding how cities and other land managers will accommodate future population growth through infill development or expansion into areas of existing open space and agriculture. Climate scenarios explore how future climate change might influence timing, distribution, and amount of precipitation, storm runoff, and water supply.

Growth Scenarios

Future water demand is affected by a number of growth and land use factors, such as population growth, planting decisions by farmers, and size and type of urban landscapes. The CWP quantifies several factors that together provide a description of future growth and how growth could affect water demand for the urban, agricultural, and environmental sectors. Growth factors are varied between the scenarios to describe some of the uncertainty faced by water managers. For example, it is impossible to predict future population growth accurately, so the CWP uses three different but plausible population growth estimates when determining future urban water demands. In addition, the CWP considers up to three different alternative views of future development density. Population growth and development density will reflect how large the urban landscape will become in 2050 and are used by the CWP to quantify encroachment into agricultural lands by 2050. Table 5-1 identifies the growth scenarios relative to current trends by using information from the California Department of Finance and the Public Policy Institute of California.

PLACEHOLDER Table 5-1 Conceptual Growth Scenarios

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of the chapter.]

For Update 2013, DWR worked with researchers at the University of California, Davis, to quantify how California might grow through 2050. The UPlan model was used to estimate a year 2050 urban footprint under the scenarios of alternative population growth and development density listed in Table 5-1 (see <http://ice.ucdavis.edu/project/uplan> for information on the UPlan model). UPlan is a simple rule-based urban growth model intended for regional or county-level modeling. The needed space for each land use type is calculated from simple demographics and is assigned based on the net attractiveness of locations to that land use (based on user input), locations unsuitable for any development, and a general plan that determines where specific types of development are permitted. Table 5-2 describes the amount of land devoted to urban use for 2006 and 2050, and the change in the urban footprint for California under each scenario. Table 5-3 describes how future urban growth could affect the land devoted to agriculture in 2050. Irrigated land area is the total agricultural footprint. Irrigated crop area is the cumulative area of agriculture, including multi-crop area, where more than one crop is planted and harvested each year. Each of the growth scenarios shows a decline in irrigated acreage over existing conditions, but to varying degrees.

PLACEHOLDER Table 5-2 Growth Scenarios (Urban) — Statewide Values

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of the chapter.]

PLACEHOLDER Table 5-3 Growth Scenarios (Agriculture) — Statewide Values

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Climate Scenarios

A significant improvement to the CWP scenarios in Update 2013 is a quantitative look at the uncertainty surrounding future climate change when evaluating the performance of new resource management strategies. After consultation with its Climate Change Technical Advisory Group, DWR chose to include 27 alternative climate scenarios in the evaluation of future strategies. These include 12 climate scenarios identified by the Governor’s Climate Action Team (CAT) for future climate change, five scenarios repeating historical climate, five scenarios repeating historical climate with a severe 3-year drought, and five scenarios repeating historical climate with a warming temperature trend. Each of the climate scenarios has separate estimates of future precipitation and temperature. Collectively these estimates provide planners with a range of precipitation and temperature that might be experienced in the future, and they are used with other factors to estimate future water demands. Refer to Volume 4, *Reference Guide*, the article “Overview of Climate-Change Scenarios Being Analyzed,” for additional information on the CAT climate scenarios.

Figures 5-1, 5-2, 5-3, and 5-4 show the variation in 30-year running average annual precipitation for locations in the Central Valley and Sierra Nevada foothill regions for the 1915-2003 historical period and U.S. Bureau of Reclamation scenarios of future climate, as well as 2011-2099 for the 12 CAT scenarios of future climate. The variation in the 30-year running average precipitation is represented as a box plot (also known as a box-and-whisker diagram or plot), which is a convenient way of graphically summarizing groups of numerical data using five numbers (the smallest observation, lower quartile [Q1], median [Q2], upper quartile [Q3], and largest observation). For example, for the historical period, the box plot for Red Bluff shows a minimum value of about 20 inches in the driest 30-year period and a maximum value of slightly over 23 inches in the wettest 30-year period. The precipitation values used to generate the box plots are from a specific point in each location.

PLACEHOLDER Figure 5-1 Variation in 30-Year Running Average Precipitation for Historical Record (1915-2003) and Alternative Scenarios of Future Simulated Climate (2011-2099) for Red Bluff

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PLACEHOLDER Figure 5-2 Variation in 30-Year Running Average precipitation for Historical Record (1915-2003) and Alternative Scenarios of Future Simulated Climate (2011-2099) for Oroville

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of the chapter.]

PLACEHOLDER Figure 5-3 Variation in 30-Year Running Average Precipitation for Historical Record (1915-2003) and Alternative Scenarios of Future Simulated Climate (2011-2099) for Fresno

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of the chapter.]

PLACEHOLDER Figure 5-4 Variation in 30-Year Running Average Precipitation for Historical Record (1915-2003) and Alternative Scenarios of Future Simulated Climate (2011-2099) for Millerton

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of the chapter.]

Figure 5-5 shows the trend in the change in average annual temperature for the Sacramento Valley floor for each climate sequence compared with the 1951-2005 historical average. A distinct upward trend in temperature change is shown in each climate scenario. However, there is considerable year-to-year fluctuation and different expectations for the long-term magnitude of temperature change. While the absolute change in temperature varies from region to region, the relative change in average annual temperature follows a pattern similar in all regions to that shown for the Sacramento River Hydrologic Region in Figure 5-5.

PLACEHOLDER Figure 5-5 Change in Average Annual Temperature from Historical 1951-2005 Average for Historical Period and 12 Scenarios of Future Climate Years 2006-2100 for Sacramento Valley Floor

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Future Environmental Requirements

The CWP uses currently unmet environmental objectives as a surrogate to estimate new requirements that may be enacted in the future to protect the environment or new ecosystem restoration actions implemented, for example, under an IRWM plan. These unmet objectives are instream flow needs or additional deliveries to managed wetlands that have been identified by regulatory agencies or by pending court decisions, but which are not yet required by law. For Update 2013, the CWP has identified the following unmet objectives:

- American (Nimbus) Department of Fish and Wildlife Values.
- Stanislaus (Goodwin).
- Ecosystem Restoration Program #1, Delta Flow Objective.
- Ecosystem Restoration Program #2, Delta Flow Objective.
- Ecosystem Restoration Program #4, Freeport.
- Trinity below Lewiston.
- Ecosystem Restoration Program #3 San Joaquin River at Vernalis.
- San Joaquin River below Friant.
- Level 4 Water Deliveries to Wildlife Refuges.

The analysis of Response Packages, described below, includes assessments of these additional objectives. These are only some of the unmet objectives in the state. In particular, they do not include additional water to protect species in the Delta as recommended in the December 2008 Delta Smelt Biological Opinion issued by the U.S. Fish and Wildlife Service or to protect salmon and several other species as recommended in from the June 2009 Biological Opinion on the Central Valley Water Project by the National Marine Fisheries Service.

Evaluating Vulnerabilities and Resource Management Strategies for Three Hydrologic Regions

Throughout development of Update 2013, DWR has worked with the Statewide Water Analysis Network (SWAN) to develop methods to regionally evaluate and quantify the costs, benefits, and tradeoffs of different resource management strategies through the application of the Water Evaluation and Planning (WEAP) modeling platform. SWAN serves as the technical advisory committee for the CWP. The CWP is testing the evaluation methods by focusing on the three hydrologic regions in the Central Valley: the Sacramento River, San Joaquin River, and Tulare Lake Hydrologic Regions (see Figure 5-6). (See Volume 4, *Reference Guide*, the article “Evaluating Response Packages for the California Water Plan Update 2013, Plan of Study.”)

PLACEHOLDER Figure 5-6 California’s Hydrologic Regions Highlighting Three Central Valley Regions Used in Test Case

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This analysis of vulnerabilities and response packages uses Robust Decision Making (RDM), a quantitative decision support methodology designed to facilitate decisions under conditions of deep uncertainty (Lempert et al. 2003; Groves and Lempert 2007). Deep uncertainty occurs when the parties to a decision do not know — or agree on — the best model for relating actions to consequences or the likelihood of future events. RDM rests on a simple concept. Rather than using models and data to describe a best-estimate future, RDM runs models over hundreds to thousands of different sets of assumptions to describe how plans perform in many plausible futures. This information is used as part of a vulnerability analysis to identify which future conditions could result in the management decisions not achieving their objectives. RDM informs a tradeoff analysis, in which different decisions are compared based on their ability to reduce vulnerabilities, their costs, and other effects. (For more information about RDM, visit www.rand.org/topics/robust-decision-making.html.) Figure 5-7 shows the key steps of an RDM analysis.

PLACEHOLDER Figure 5-7 Robust Decision-Making Steps Used in Water Plan Analysis

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of the chapter.]

The CWP is using this RDM framework to first evaluate the vulnerability of the current management system in the Central Valley (Steps 1-3 in Figure 5-7) and then compare how different water management response packages could improve the resilience of the system (Steps 1-4 in Figure 5-7). Specifically, the vulnerability analysis explores how well the Central Valley water management system would perform under a wide range of futures defined by the growth and climate scenarios described above. System performance is evaluated with respect to urban and agricultural unmet demand, unmet instream flow requirements and objectives, and groundwater levels. Performance of the water management system is evaluated under a number of alternative scenarios reflecting future population growth, changes to irrigated land area, and future climate variability.

The CWP is testing methods to regionally quantify and evaluate the costs, benefits, and tradeoffs of different resource management strategies through the application of the WEAP modeling platform. The Central Valley WEAP application (see Box 5-4) was applied over a large set of growth and climate scenarios. For each scenario, an assessment of water supply, demand, and unmet demand in the urban and agricultural sectors was performed. The model also reported on changes in groundwater and how frequently instream flow requirements were met. Figures 5-8 and 5-9 show agricultural supply demand and unmet demand results of a single simulation (out of many) performed for the Sacramento River Hydrologic Region and the San Joaquin and Tulare Lake hydrologic regions, respectively. This simulation is based on historical supply conditions and Current Trends population and urban density scenarios. The results presented below demonstrate the broad vulnerabilities faced by the three hydrologic regions evaluated. They are not sufficiently detailed for planning and decision-making at a scale finer than the hydrologic region.

PLACEHOLDER Box 5-4 Central Valley WEAP Model

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of the chapter.]

In the Sacramento River Hydrologic Region, demand is highly variable and declines slightly over time as urbanization reduces irrigated land area. Supply largely meets demand, except for simulated years 2023 and 2024, which corresponds to a repeat of 1976-1977 drought conditions. In the San Joaquin River and Tulare Lake hydrologic regions, the model projects significant unmet demands. Shortages are particularly acute under the dry conditions of 1977 and the early 1990s. These results are consistent with the greater water supply constraints present in these regions today.

PLACEHOLDER Figure 5-8 Single Simulation of Agricultural Supply, Demand, and Unmet Demand for the Sacramento River Hydrologic Region

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of the chapter.]

PLACEHOLDER Figure 5-9 Single Simulation of Agricultural Supply, Demand, and Unmet Demand for the San Joaquin River and Tulare Lake Hydrologic Regions

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of the chapter.]

Reliability, defined as the percentage of years in which demand is sufficiently met by supply, is one of several different ways the CWP summarizes the projections of future urban and agricultural conditions. Figure 5-10 shows the range of reliability results for both sectors in the Sacramento River and in the San Joaquin River and Tulare Lake hydrologic regions. In the figure, each dot indicates the reliability for one of 128 simulations (the results shown reflect a subset of all 243 futures evaluated). The vertical lines indicate the median of each distribution, and the shaded areas indicate the results that fall within the middle half of the distribution (between the 25th and 75th percentiles). The figure clearly shows that both the urban and agricultural sectors in the Sacramento River Hydrologic Region are projected to remain highly reliable across the futures evaluated. The urban reliability for the San Joaquin River and Tulare Lake hydrologic regions is less than 90 percent in only about 10 percent of the future scenarios. For the

agricultural sector, reliability is broadly lower, with a median result of about 78 percent reliability. In some futures, reliability falls below 50 percent.

PLACEHOLDER Figure 5-10 Range of Urban and Agricultural Reliability Results Across Futures

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of the chapter.]

Figure 5-11 shows results for how groundwater storage would change in the Sacramento River Hydrologic Region and San Joaquin and Tulare Lake hydrologic regions for each of the futures evaluated. In the Sacramento River Hydrologic Region, more than half the futures lead to increases in groundwater levels. This is caused by climate scenarios that are wetter than historical averages and reduced agricultural water use resulting from urbanization of agricultural lands. In the south of the Delta, more than 75 percent of the futures show declining groundwater levels.

PLACEHOLDER Figure 5-11 Range of Groundwater Storage Changes Across Futures

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Figure 5-12 shows how the reliability for six instream flow requirements varies across the futures. For four of the six — those located in the northern portion of the Central Valley region — the requirements are always met. The reliability for the Merced and Friant instream flow requirements, however, are less than 100 percent in most futures.

PLACEHOLDER Figure 5-12 Range of Instream Flow Requirement Reliability Across Futures

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The CWP next evaluated which future conditions would lead to low reliability in the San Joaquin and Tulare Lake hydrologic regions. Using statistical analysis, the CWP identified that the two most important factors driving low reliability outcomes are futures with high temperature and low precipitation in future decades. The specific growth scenarios (variations in population and land use density) are of secondary importance.

For the urban sector, reliability is less than 95 percent in about half of the futures. Figures 5-13 and 5-14 show these results graphed against the temperature trend (vertical axis) and change from historical precipitation levels (horizontal axis) of each simulation for two bounding land use scenarios — low population growth/high land-use density (Figure 5-13) and high population/low density (Figure 5-14). In these graphs, red X's are those results that are less than 95-percent reliable and green circles are those that are more than 95-percent reliable. For the low population growth/high-density land use scenario, four of the five low reliability results correspond to the climate scenarios in which temperature is greater than the 65 degrees and precipitation declines more than 13 percent from historical levels (Figure 5-13).

PLACEHOLDER Figure 5-13 Climate Conditions Leading to Low Urban Reliability in the San Joaquin River and Tulare Lake Hydrologic Regions for the Low-Population and High-Density Land Use Scenario

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The sensitivity of urban reliability to climate, however, increases significantly under the land use scenario in which population is high and density is low (Figure 5-14). For these futures, nine of the 22 climate scenarios are low reliability. The climate conditions consistent with these low reliability outcomes is much broader — warmer than 65 degrees but including any negative temperature trend (specifically, less than a 2 percent increase).

PLACEHOLDER Figure 5-14 Climate Conditions in the San Joaquin River and Tulare Lake Hydrologic Regions Leading to Low Urban Water Reliability for the High-Population and Low-Density Land Use Scenario for Three Sets of Climate Scenarios

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of the chapter.]

In the agricultural sector for the San Joaquin River and Tulare Lake hydrologic regions, almost all futures are low reliability (less than 95 percent). Figure 5-15 shows results for the current trends population and density land-use scenarios. In this graphic, as all but one result is low reliability, notice how reliability generally declines in warmer and dryer climate conditions (upper left). The warmest and driest climate conditions lead to reliability below 50 percent. These results clearly indicate that the agricultural sector within the San Joaquin River and Tulare Lake hydrologic regions will likely continue to experience low supply reliability, and perhaps extreme reliability problems, without additional water management strategies.

PLACEHOLDER Figure 5-15 Climate Conditions Leading to Low Agricultural Reliability Results in the San Joaquin River and Tulare Lake Hydrologic Regions

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In summary, the Sacramento River Hydrologic Region is projected to remain highly reliable with stable groundwater storage levels in most futures evaluated — even under alternative climate change projections. In the combined results for the San Joaquin River and Tulare Lake regions, however, significant shortages occur. In the urban sector, reliability is below 95 percent in many futures, particularly those with warmer and drier conditions, as well as high population growth and low land-use density. For the agricultural sector, reliability is consistently below 95 percent and can be lower than 50 percent in the hottest and driest climate scenarios.

Evaluation of Management Response Packages

The CWP is evaluating how implementing alternative mixes of resource management strategies could reduce the Central Valley vulnerabilities described above. Management response packages are each comprised of a mix of resource management strategies selected from Volume 3 and implemented at

investment levels and locations, as described in the Plan of Study (see Volume 4, *Reference Guide*, the article “Evaluating Response Packages for the California Water Plan Update 2013, Plan of Study”). The focus of this analysis will be on the Sacramento River, San Joaquin River, and Tulare Lake hydrologic regions, and will include strategies that are regionally significant. For example, a response package could include improvements in urban water-use efficiency that is expected to increase to 20 percent savings by 2020, additional groundwater storage, or increasing water for ecosystem restoration.

These response packages do not represent a definitive set of alternatives; instead, they illustrate different levels of strategy diversification that could be taken to address water management challenges. Table 5-4 describes the six response packages that are currently being evaluated. They are designed to incrementally increase in diversification in each subsequent diversification level. The first two add strategies that can be implemented locally, such as water use efficiency, and that require some regional coordination and infrastructure investment, such as conjunctive management and recycled municipal water. Diversification Levels 3-6 all include additional strategies designed to meet new instream flow targets and lead to the recovery of the region’s groundwater basins. Diversification Level 4 seeks to maximize water use efficiency and includes the final two strategies, which involve one or two reservoirs — north of Delta and north and south of Delta, respectively.

PLACEHOLDER Table 5-4 Resource Management Strategies Used in Plan of Study

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of the chapter.]

Figure 5-16 shows how the consideration of cost or level of effort can define a tradeoff, drawn from the proof-of-concept analysis developed for the CWP (Groves and Bloom 2013). The figure plots each response package by reduction in vulnerability (vertical axis) and level of effort (horizontal axis). In this analysis, the more-effective response packages cost more. However, additional efforts beyond the Increased Efficiency response package do not further reduce vulnerabilities. Thus, Increased Efficiency is always preferable to Moderate Increases or Aggressive Infrastructure. The line on the graph traces out a simple trade-off curve that could be considered when choosing among strategies.

PLACEHOLDER Figure 5-16 Tradeoff between Vulnerability Reduction and Cost of Example Response Packages from Proof-of-Concept Analysis

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Statewide 2050 Water Demands

The section above described a vulnerability assessment for the Sacramento River, San Joaquin River, and Tulare Lake hydrologic regions that was conducted to demonstrate application of RDM techniques. In this section a description is provided for how future statewide water demands might change under scenarios organized around themes of growth and climate change described earlier in this chapter. The change in water demand from 2006 to 2050 is estimated for each hydrologic region for agriculture and urban sectors under nine growth scenarios and 13 scenarios of future climate change. The climate change scenarios included the 12 CAT scenarios described earlier in this chapter and a 13th scenario representing a repeat of the historical climate (1962-2006) to evaluate a “without climate change” condition.

Figure 5-17 shows the change in statewide water demands for the urban and agricultural sectors under nine growth scenarios, with variation shown across 13 climate scenarios. The nine growth scenarios include three alternative population growth projections and three alternative urban land development densities, as shown in Table 5-1. The change in water demand is the difference between the historical average for 1998 to 2005 and future average for 2043 to 2050. Urban demand is the sum of indoor and outdoor water demand where indoor demand is assumed not to be affected by climate. Outdoor demand, however, depends on such climate factors as the amount of precipitation falling and the average air temperature. The solid blue dot in Figure 5-17 represents the change in water demand under a repeat of historical climate, while the open circles represent change in water demand under 12 scenarios of future climate change.

Urban demand increased under all nine growth scenarios consistent with population growth. On average, urban demand increased by about 3200 thousand acre-feet (taf) under the three low-population scenarios, 5300 taf under the three current-trend population scenarios, and about 9200 taf under the three high-population scenarios when compared with the historical average of 8200 taf. The results show that change in future urban water demands is less sensitive to housing density assumptions or climate change than to assumptions about future population growth.

Agricultural water demand decreases under all future scenarios owing to reduction in irrigated lands as a result of urbanization and background water conservation, when compared with historical average water demand of 30,200 taf. Under the three low-population scenarios, the average reduction in water demand was about 3,200 taf, while it was about 4,500 taf for the three high-population scenarios. For the three current trend population scenarios, this change was about 3,700 taf. The results show that low-density housing would result in more reduction in agricultural demand because more lands are lost under low-density housing than high-density housing.

PLACEHOLDER Figure 5-17 Change in Statewide Agricultural and Urban Water Demands for 117 Scenarios from 2006-2050 (million acre-feet per year)

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of the chapter.]

Figure 5-18 shows the change in water demand for the agricultural and urban sectors for each of the 10 hydrologic regions. For each of the nine growth scenarios shown in Table 5-1, change in water demand was determined based on a repeat of a historical climate pattern and for 12 alternative scenarios of future climate change. It is evident from Figure 5-18 that future climate change presents a significant uncertainty with respect to future water demands. All regions show an increase in urban water demands and decrease in agricultural water demands. The South Coast is expected to have the greatest increase in urban water demands in response to population growth. Additional details about the regional water demands can be found in the Volume 2, *Regional Reports*.

PLACEHOLDER Figure 5-18 Change in Regional, Agricultural, and Urban Water Demands for 117 Scenarios from 2006-2050 (million acre-feet per year)

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of the chapter.]

Limitations of Future Water Management Analysis for Update 2013

The analysis of resource management strategies developed for Update 2013 can allow comprehensive analysis of strategy performance when conducted at sufficient detail. However, all technical endeavors are subject to the limits of the particular technology being used and the financial resources available. Below are some of the important limitations the CWP team has identified for the analysis used for Update 2013.

- For Update 2013, DWR tested a vulnerability assessment for the Sacramento River, San Joaquin River, and Tulare Lake hydrologic regions, which included an assessment of water supply, demand, and unmet demand in the urban and agricultural sectors. The analysis for the remaining seven hydrologic regions in California was coarser and focused on quantifying future water demands under alternative future scenarios.
- Many of the resource management strategies identified in Volume 3 can be represented in the Update 2013 application of WEAP, particularly those related to the water management objectives to reduce water demand, improve operational efficiency and transfers, and increase water supply. However, the analysis for Update 2013 had limited ability to none at all with regard to quantifying strategies that improve flood management, improve water quality, and practice resource stewardship. These will be considered as part of future enhancements to the CWP.
- The analysis for Update 2013 quantified some of the resource management strategy benefits for providing a supply benefit, improving drought preparedness, providing environmental benefits, improving operational flexibility and efficiency, and reducing groundwater overdraft. There was limited to no ability to quantify benefits for improving water quality, reducing flood impacts, energy benefits, and recreational opportunities. Quantifying these other benefits will be considered as part of future enhancements to the analytical framework.
- The analysis to support the CWP is designed to represent the water management system at sufficient detail to reflect important planning conditions, but not for detailed water project operations or to capture all detailed flows through the system. As a result, many system features, such as groundwater basins, are simplified to capture the broad regional behavior of groundwater recharge, groundwater storage, and hydrologic connection to rivers and lakes. Significant refinement in the analysis will be needed to support decisions by individual water districts.

Managing for Sustainability

With a growing recognition that California's water systems are over allocated — and faced with climate change, growing population, and more stringent environmental requirements — decision-makers, water managers, and planners are becoming increasingly aware of the need to both sustainably manage water and respond to changing availability and constraints on water. In Updates 2005 and 2009, the State refocused attention on the sustainability of California's water systems and ecosystems in light of current water management practices and expected future changes. A number of concurrent efforts are underway at the regional, State, and federal levels to manage natural resources more sustainably (see Volume 4, Reference Guide, the article "Examples of Managing for Sustainability," for more information). The California Water Sustainability Indicators Framework (Framework), developed as part of Update 2013, brings together water sustainability indicators that will provide information regarding water system conditions and their relationships to ecosystems, social systems, and economic systems. Figure 5-19 shows a conceptual representation of the Framework, and how communities interact to develop

sustainability indicators using analytical information that ultimately is used to drive our water policy and to inform other end uses.

PLACEHOLDER Figure 5-19 Conceptual California Water Sustainability Indicators Framework

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Sustainability indicators are qualitative or quantitative parameters from monitoring programs (e.g., streamflow) selected to represent parts of ecological, social, or economic systems. (See Volume 4, *Reference Guide*, the article “California Water Sustainability Indicators Framework.”) The evaluation of the sustainability indicators reveals how our actions or inaction can degrade or improve conditions that lead to water sustainability. The Framework is built around statements of intent (e.g., objectives) and domains (e.g., water quality). Reporting indicator condition is based on the principle of measuring how far a current condition is from a desired condition. The Framework is intended to support reporting of conditions to a wide array of water and environmental stakeholders, the public, and decision-makers to build knowledge and to enhance adaptive decision-making and policy change. A detailed representation of the Framework is depicted in Figure 5-20, showing several steps involved with linking sustainability goals and objectives into public policy by using the most accurate sources of scientific information. Both the conceptual and detailed descriptions of the Framework highlight the cyclical and collaborative nature of efforts to develop sustainable policies.

PLACEHOLDER Figure 5-20 Details of the California Water Sustainability Indicators Framework

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Goals and objectives are just one way to organize our thinking about an evaluation of sustainability. Another common approach is to evaluate progress within areas of concern or domains (e.g., ecosystem health). Five domains of natural and human systems are defined for the Framework (Table 5-5), which capture most of the environmental, social, and economic concerns about water sustainability — water supply reliability, water quality, ecosystem health, adaptive and sustainable management, and social benefits and equity.

PLACEHOLDER Table 5-5 Water Sustainability Domains

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of the chapter.]

Explicit criteria must be used to select indicators to ensure that the resulting evaluation is robust and usable in decision-making. For Update 2013, about 80 candidate indicators were selected on the basis of the indicator selection criteria, from an extensive review of sustainability and water system indicators around the world and in California. This exercise resulted in a set of candidate indicators that efficiently covered the sustainability objectives, while also covering the five domains (e.g., water quality). The selected indicators are listed in Volume 4, *Reference Guide*, in Appendix D of the article “California Water Sustainability Indicators Framework.”

Testing Sustainability Indicators with Pilot Studies

To assess the usefulness of the Framework for measuring water sustainability, it was tested at the state and regional scales. Draft sustainability goals and objectives were developed, based on Update 2009 objectives and resources management strategies. Indicators corresponding to the goals and objectives were chosen from the global literature and previous guidance in the CWP and other state planning documents. In the case of the state pilot, the sustainability goals and objectives, as well as the candidate indicators, were presented to various Update 2013 stakeholder forums, including the sustainability indicators interagency workgroup, State Agency Steering Committee, Public Advisory Committee, and Tribal Advisory Committee. The background, methods, results, and data downloads for the state and regional scale analyses are available at <http://indicators.ucdavis.edu>.

Statewide Pilot

Water sustainability indicators were evaluated at varying levels of specificity across the state, with the unit area of analysis depending on the specific indicator and data availability. For example, the water footprint and public perceptions of water management are measured at the state scale, whereas groundwater quality is measured at the well scale. Indicator evaluation included a conversion of the data to an equivalent sustainability score. The scores were calculated at the unit area of analysis, as well as being aggregated to each of the 10 hydrologic regions. The sections that follow include discussion of this analysis organized around the five water sustainability domains (see Table 5-5).

Water Footprint

A preliminary assessment has been conducted for California's Water Footprint. The Water Footprint can help identify water-related risks associated with California's consumption patterns. This risk results in part from the energy and hydraulic systems that distribute water, but also changing hydrologic and ecologic conditions in California and in places that produce goods and services consumed in the state. By demonstrating the degree to which our state has externalized its Water Footprint by importing water-intensive goods, the Water Footprint analysis may encourage State and regional water strategic plans to consider the vulnerability of water import dependency. The Water Footprint comprises three functions of water labeled by color: green water, blue water, and grey water. See Box 5-5 for additional information about the Water Footprint as an index of sustainability.

PLACEHOLDER Box 5-5 Water Footprint as an Index of Sustainability

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The current assessment estimates that California's overall Water Footprint — a measure of the total volume of freshwater that is used to produce the goods and services consumed by Californians — is 65 million acre feet (maf) per year (Figure 5-21). This estimate represents the total amount of water used to support California's population and includes water for producing agricultural and industrial goods, and for residential, commercial, and institutional purposes. Nearly 30 percent of the total Water Footprint, or 20 maf, is associated with goods produced and consumed in California, which is referred to as California's Internal Water Footprint. About 70 percent of California's Water Footprint (45 maf) is associated with goods that are consumed in California but are produced outside of the state, which is referred to as California's External Water Footprint. The majority of California's External Water

Footprint relates to goods imported from other states and to a lesser degree from California's major foreign trading partners (e.g., Mexico, Canada, China).

PLACEHOLDER Figure 5-21 California's Blue and Green Water Footprint

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of the chapter.]

Water Quality

Water Quality Index: There are many ways to measure water quality, including physical (e.g., temperature), chemical (e.g., pesticides), and biological (e.g., healthy algae communities) attributes. Water quality is affected by land and water development, as well as by natural processes. Land development leads to runoff of pollutants into local waterways and contributes to the degradation of water quality. One indicator of potential water quality is "impervious cover," which is the proportion of a watershed that has been covered by structures and related development. Streams in most hydrologic regions appear to have good water quality, based on runoff from developed areas (Figure 5-22). Streams in more urbanized regions are more likely to have moderate water quality scores. Averages at the hydrologic regions scale do not reflect local condition, which may vary from exceptionally good to very degraded. In addition, specific point sources of impacts on water quality from agricultural drainage, for example, are not captured in this approach.

PLACEHOLDER Figure 5-22 Water Quality Index Score for Hydrologic Regions

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Ecosystem Health

Geomorphic Process: When land is developed, it changes stormwater runoff patterns and timing, constrains and modifies stream channels, and can exacerbate local and regional flooding. As is the case for water quality, impervious land cover is an indicator of land development that is useful for understanding modification of geomorphic processes. Streams in the urbanized San Francisco Bay and South Coast Regions are more likely to experience modified geomorphic processes than rural and undeveloped areas (Figure 5-23).

PLACEHOLDER Figure 5-23 Geomorphic Process Score for Hydrologic Regions

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California Stream Condition Index: Aquatic ecosystems have many varying attributes and processes that can be used to indicate condition of the water body relative to standards of ecosystem health. One common attribute used as an index is the composition of fish and invertebrate communities, relative to historic or reference conditions. The California Stream Condition Index was developed by the State Water Resources Control Board (Mazor et al., in prep.), as a way to estimate aquatic ecosystem health. The index is based on the presence of aquatic invertebrates, which are sensitive to stream disturbance and pollution. The analysis shows that ecosystem health in most regions appears to be good, except in the urbanized San Francisco Bay and South Coast Regions (Figure 5-24).

PLACEHOLDER Figure 5-24 California Stream Condition Index Score by Site and for Hydrologic Regions

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of the chapter.]

Native Fish Communities: Scientists have mapped the current and historic occurrence of most of California’s native fish and many non-native fish (Moyle 2002; Santos et al. 2013). The ratio of current ranges to historic ranges was used to calculate a score for fish communities. The analysis shows that in the northern half of California, most fish communities have nearly all native species present. By contrast, in the agricultural Tulare Lake Basin, urban South Coast, and desert regions, many streams have few and sometimes no native fish species (Figure 5-25).

PLACEHOLDER Figure 5-25 Fish Community Score for Hydrologic Regions

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Adaptive and Sustainable Management

Public Perception of Water Systems: The public expects clean and readily available water. Their expectation is usually that this public resource will be provided through State and local agencies, using public funds and based on policies that maintain the resource in trust. Measuring public understanding and support for water management and water policies is one proxy measure for how well State and local agencies are stewarding public trust resources. Three metrics were used to gauge public perceptions of current and future water supply management: (1) security of a region’s water supply, (2) threat of climate change effects on water availability, and (3) appropriate management strategies to sustainably manage water systems in the future. The data were from surveys conducted by the Public Policy Institute of California (<http://www.ppic.org/main/datadepot.asp>).

Security of Water Supply: A little over one-third of respondents were very concerned about the current state of water supplies (Figure 5-26), and a similar proportion were concerned about water availability by 2019 (Figure 5-27), though these perceptions varied by region. A lower regional score is illustrative of a higher level of concern about water supply security for the region.

PLACEHOLDER Figure 5-26 Public Perception by Region of Threats to the Public Water Supply

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of the chapter.]

PLACEHOLDER Figure 5-27 Public Perception of Security of Future Water Supplies

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Threat of Climate Change Effects on Water Availability: At least half of the respondents have some level of concern about the effects on future water availability from droughts influenced by climate change (Figure 5-28). This perception varied only slightly by region. A lower regional score is illustrative of a higher level of concern about the threat of climate change in the region.

PLACEHOLDER Figure 5-28 Public Perception of Effects of Climate Change on Future Water Supplies

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of the chapter.]

Future Sustainable Management of Water Systems: When asked about water management to meet future human needs, half of Californians favored managing and using existing supplies more efficiently (Figure 5-29). More than half of the people surveyed favored spending more money on improving conditions for native fish, with a third of the people favoring doing so even if their water bills went up (Figure 5-30).

PLACEHOLDER Figure 5-29 Public Perception of Future Water Management Strategies to Maintain Water Supply

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of the chapter.]

PLACEHOLDER Figure 5-30 Public Favor for Improving Conditions for Fish, Including Payment Strategies

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of the chapter.]

Social Benefits and Equity

Groundwater and Drinking Water Contamination: Water sustainability rests on the principle that people have equitable access to public trust resources such as water, and disparities in benefits and burdens are minimized. Accordingly, access to clean drinking water is a key component of water sustainability. In California, there are many contaminants that can and have made their way into groundwater, the primary drinking water source for the majority of Californians (State Water Resources Control Board 2013). Because contaminant concentrations can be reduced to levels below legal thresholds through mixing with cleaner source-waters and through treatment, most people drink clean water most of the time in California. The California Legislature passed Assembly Bill 2222 in 2008, requiring the State Water Resources Control Board to report to the Legislature on communities that rely on contaminated groundwater and principal contaminants in groundwater. Nitrate was identified as the most common groundwater contaminant originating from human activities and was found to be second overall after arsenic. Certain community water services rely exclusively on groundwater and have exceeded maximum contaminant levels (MCLs) for various contaminants at some time in the last 10 years. The presence of nitrates and the reliance on contaminated groundwater are two indicators that can be used to understand where in California groundwater is affected by contaminants. Regions of California vary in both the concentration of nitrates in groundwater and the community reliance on contaminated water (Figure 5-31). Inland and coastal agricultural regions have the highest number of communities reliant on contaminated groundwater exceeding the nitrate MCL of 45 milligrams per liter.

PLACEHOLDER Figure 5-31 Groundwater and Drinking Water Contamination Score for Hydrologic Regions

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of the chapter.]

Regional Pilot

To test the Framework at the regional scale, the CWP considered a dozen potential pilot study areas. The Santa Ana Watershed Project Authority (SAWPA) was selected as a willing and able regional pilot partner because of their technical capacity and the fact that they were currently engaging a broad range of stakeholders in regional planning, through their One Water One Watershed 2.0 (OWOW2.0) process (visit <http://www.sawpa.org/owow/>). The OWOW2.0 process relies on “Pillars,” which are stakeholder groups focusing on particular issues of regional importance, as well as on advisory committees of member water agencies. In partnership with SAWPA and the Council for Watershed Health, goals, objectives, and candidate indicators were developed to test the Framework and evaluate water sustainability for the regional pilot.

Summary

Integrated water management is the basis for California’s water planning. This umbrella approach recommends that California and its regions consider how a portfolio of resource management strategies, as described in Volume 3, might meet multiple water management objectives in light of many risks and uncertainties and ensure sustainable use of water resources. DWR and other entities are conducting various risk assessments so that risks can be better balanced with the rewards for improved management. Update 2013 introduced a water sustainability indicators framework to ascertain how the objectives of the CWP, associated resource management strategies, and recommended actions would lead to sustainable water use and supply for the state and its 10 hydrologic regions.

Update 2013 evaluated how statewide and regional water demands might change by 2050 in response to uncertainties surrounding future population growth, land use changes, future climate change, and other factors. These future uncertainties will play out quite differently across the regions of California, so each region will need to choose and implement a portfolio of resource management strategies that consider regional water management challenges. Update 2013 also conducted a more comprehensive vulnerability analysis for the Sacramento River, San Joaquin River, and Tulare Lake regions to test longer term analytical enhancements for the CWP. This analysis tested different response packages, or combinations of resource management strategies, under many future uncertainties. These response packages help decision-makers, water managers, and planners develop and evaluate integrated water management plans that invest in actions with more sustainable outcomes.

References

References Cited

California Department of Water Resources. 2012. *2012 Central Valley Flood Protection Plan*. 191 pp. Central Valley Flood Management Protection Program.

- 1 Groves, D.G., and R.J. Lempert. 2007. "A New Analytic Method for Finding Policy-Relevant Scenarios,"
2 Global Environmental Change Part A: Human & Policy Dimensions, Vol. 17, No. 1, 2007, pp.
3 73-85.
- 4 Groves, D.G., and E. Bloom. 2013. *Robust Water Management Strategies for the California Water Plan:
5 Proof of Concept Analysis*. 70 pp. Santa Monica (CA): RAND Corporation.
- 6 Lempert, R.J., S.W. Popper, and S.C. Bankes. 2003. *Shaping the Next One Hundred Years: New Methods
7 for Quantitative, Long-term Policy Analysis*. 187 pp. Santa Monica (CA): RAND Corporation.
- 8 Lempert, R.J., S.W. Popper, D.G. Groves, N. Kalra, J.R. Fischbach, S.C. Bankes, B.P. Bryant,
9 M.T. Collins, K. Keller, A. Hackbarth, L. Dixon, T. LaTourrette, R.T. Reville, J.W. Hall,
10 C. Mijere, D.J. McInerney. 2013. *Making Good Decisions Without Predictions: Robust Decision
11 Making for Planning Under Deep Uncertainty*. RAND Corporation, RB-9701, Santa Monica
12 (CA).
- 13 Moyle, P.B. 2002. *Inland Fishes of California*. Revised and Expanded. Berkeley (CA): University of
14 California Press Books. 517 pp.
- 15 Mazor, R.D., A. Rehn, P.R. Ode, M. Engeln, K. Schiff, D. Herbst, and C.P. Hawkins. In prep.
16 Maximizing the Applicability of Bioassessment Scoring Tools in Environmentally Complex
17 Regions.
- 18 Purkey, D., A. Huber-Lee, D. Yates, and M. Hanemann. 2007. Integrating a Climate Change Assessment
19 Tool into Stakeholder-Driven Water Management Decision-Making Processes in California.
20 Water Resources Management, 21, pp. 315-329.
- 21 Purkey, D., and A. Huber-Lee. 2006. A DSS for long-term water utility planning. Southwest Hydrology.
22 4. pp. 18-31.
- 23 Santos, N.R., J.V.E. Katz, P.B. Moyle, J.H. Viers. 2013. PISCES: A Programmable Information System
24 for Management and Analysis of Aquatic Species Range Data. In review.
- 25 State Water Resources Control Board. 2013. *Communities that Rely on a Contaminated Groundwater
26 Source for Drinking Water*. Report to the Legislature. Sacramento (CA). 181 pp.
- 27 Yates, D., H. Galbraith, D. Purkey, A. Huber-Lee, J. Sieber, J. West, S. Herrod-Julius, and B. Joyce. 2008.
28 Climate warming, water storage and chinook salmon in California's Sacramento Valley. Climatic
29 Change, 91, pp. 3-4.
- 30 Yates, D., D. Purkey, H. Galbraith, A. Huber-Lee, and J. Sieber. 2005. WEAP21 a demand, priority, and
31 preference driven water planning model: Part 2, Aiding freshwater ecosystem service evaluation."
32 Water International, 30, 4, pp. 501-512.

- 1 Yates, D., D. Purkey, J. Sieber, A. Huber-Lee, H. Galbraith, J. West, S. Herrod-Julius, C. Young, B.
2 Joyce, and M. Rayej. 2009. Climate driven water resources model of the Sacramento Basin,
3 California. *Journal of Water Resources Planning and Management*, 135:5, pp. 303-313.
- 4 Yates, D., J. Sieber, D. Purkey, and A. Huber-Lee. 2005. WEAP21 a Demand-, Priority-, and Preference-
5 Driven Water Planning Model: Part 1, Model Characteristics. *Water International*, 30:4, pp. 487-
6 500.

Table 5-1 Conceptual Growth Scenarios

Scenario	Population Growth	Development Density
LOP-HID	Lower than Current Trends	Higher than Current Trends
LOP-CTD	Lower than Current Trend	Current Trends
LOP-LOD	Lower than Current Trends)	Lower than Current Trends
CTP-HID	Current Trends	Higher than Current Trends
CTP-CTD	Current Trends	Current Trends
CTP-LOD	Current Trends	Lower than Current Trends
HIP-HID	Higher than Current Trends	Higher than Current Trends
HIP-CTD	Higher than Current Trends	Current Trends
HIP-LOD	Higher than Current Trends	Lower than Current Trends

Table 5-2 Growth Scenarios (Urban) — Statewide Values

Scenario	2050 Population (millions)	Population Change (millions) 2006 ^a to 2050	Development Density	2050 Urban Footprint (million acres)	Urban Footprint Increase (million acres) 2006 ^b to 2050
LOP-HID	43.9 ^c	7.8	High	5.6	0.3
LOP-CTD	43.9	7.8	Current Trends	6.2	1.0
LOP-LOD	43.9	7.8	Low	6.5	1.2
CTP-HID	51.0 ^d	14.9	High	6.3	1.1
CTP-CTD	51.0	14.9	Current Trends	6.7	1.5
CTP-LOD	51.0	14.9	Low	7.1	1.9
HIP-HID	69.4 ^e	33.3	High	6.8	1.6
HIP-CTD	69.4	33.3	Current Trends	7.6	2.4
HIP-LOD	69.4	33.3	Low	8.3	3.1

Notes:

^a 2006 population was 36.1 million.^b 2006 urban footprint was 5.2 million acres.^c Values modified by the California Department of Water Resources (DWR) from the Public Policy Institute of California.^d Values provided by the California Department of Finance.^e Values modified by DWR from the Public Policy Institute of California.

Table 5-3 Growth Scenarios (Agriculture) — Statewide Values

Scenario	2050 Irrigated Land Area^a (million acres)	2050 Irrigated Crop Area^b (million acres)	2050 Multiple Crop Area^c (million acres)	Reduction in Irrigated Crop Area (million acres) 2006 to 2050
LOP-HID	8.6	9.2	0.65	0.1
LOP-CTD	8.4	9.0	0.63	0.3
LOP-LOD	8.3	8.9	0.63	0.4
CTP-HID	8.4	9.0	0.63	0.3
CTP-CTD	8.2	8.9	0.62	0.4
CTP-LOD	8.1	8.7	0.61	0.6
HIP-HID	8.2	8.9	0.62	0.4
HIP-CTD	8.0	8.6	0.60	0.7
HIP-LOD	7.8	8.4	0.58	0.9

Notes:

^a 2006 Irrigated land area was estimated by the California Department of Water Resources (DWR) to be 8.7 million acres.

^b 2006 Irrigated crop area was estimated by DWR to be 9.3 million acres.

^c 2006 multiple crop area was estimated by DWR to be 0.65 million acres.

Table 5-4 Resource Management Strategies Used in Plan of Study

Response Package	Resource Management Strategy Category				
	Environmental Flow Recovery Targets	Groundwater Recovery Targets	Water Use Efficiency	Recycled Municipal Water	Conjunctive Management
Currently Planned Management	Current	Groundwater levels cannot drop below Historical low	Urban: 20% by 2020	Current	Current
Diversification Level 1			Urban: 30% by 2030		
Diversification Level 2			Agriculture: 10% by 2020	50% recycled water use by 2030	Maximum of 20 TAF/month per planning area to be banked (SOD) starting in 2020
Diversification Level 3	Sacramento River at Freeport Stanislaus AFRP 2 ERP Target 1 ERP Target 2 (all by 2015)	Groundwater levels cannot drop below midpoint of 1970-2005 minimum and initial conditions (starting 2015)	Urban: 30% by 2030; 35% by 2040 Agriculture: 10% by 2020; 15% by 2030		Maximum of 40 TAF/month per planning area to be banked (SOD) starting in 2020
Diversification Level 4			Urban: 30% by 2030; 40% by 2040 Agriculture: 10% by 2020; 20% by 2030		
Diversification Level 5					

Table 5-5 Water Sustainability Domains

Domain Name	Description
Water Supply Reliability	The availability or provision of water of sufficient quantity and quality to meet water needs for health and economic well-being and functioning
Water Quality	The chemical and physical quality of water to meet ecosystem and drinking water standards and requirements
Ecosystem Health	The condition of natural system, including terrestrial systems interacting with aquatic systems through runoff pathways
Adaptive and Sustainable Management	A management system that can nimbly and appropriately respond to changing conditions and is equitable and representative of the various needs for water in California
Social Benefits and Equity	The health, economic, and equity benefits realized from a well-managed water system, including management of water withdrawal and water renewal

Figure 5-1 Variation in 30-Year Running Average Precipitation for Historical Record (1915-2003) and Alternative Scenarios of Future Simulated Climate (2011-2099) for Red Bluff

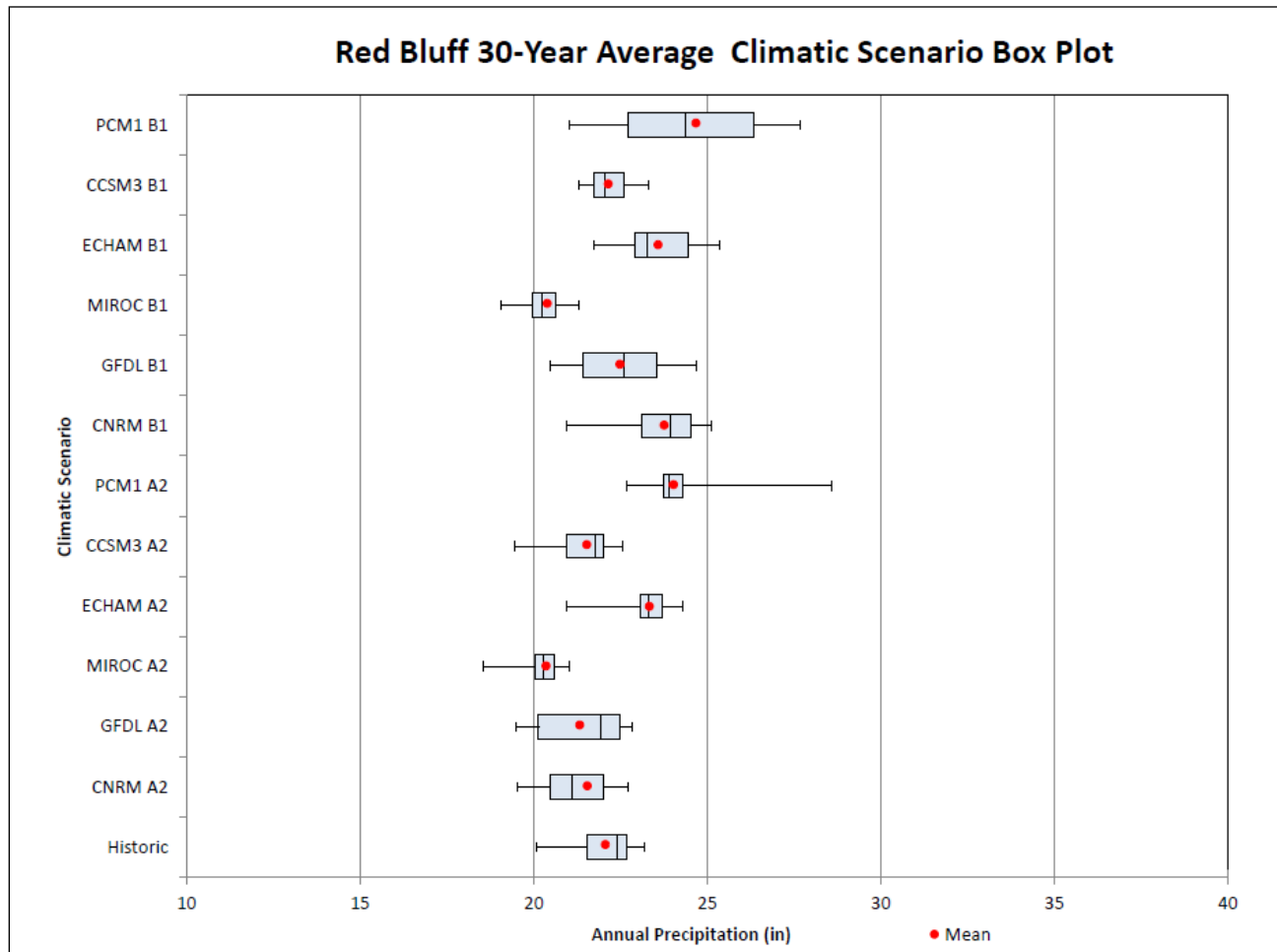


Figure 5-2 Variation in 30-Year Running Average Precipitation for Historical Record (1915-2003) and Alternative Scenarios of Future Simulated Climate (2011-2099) for Oroville

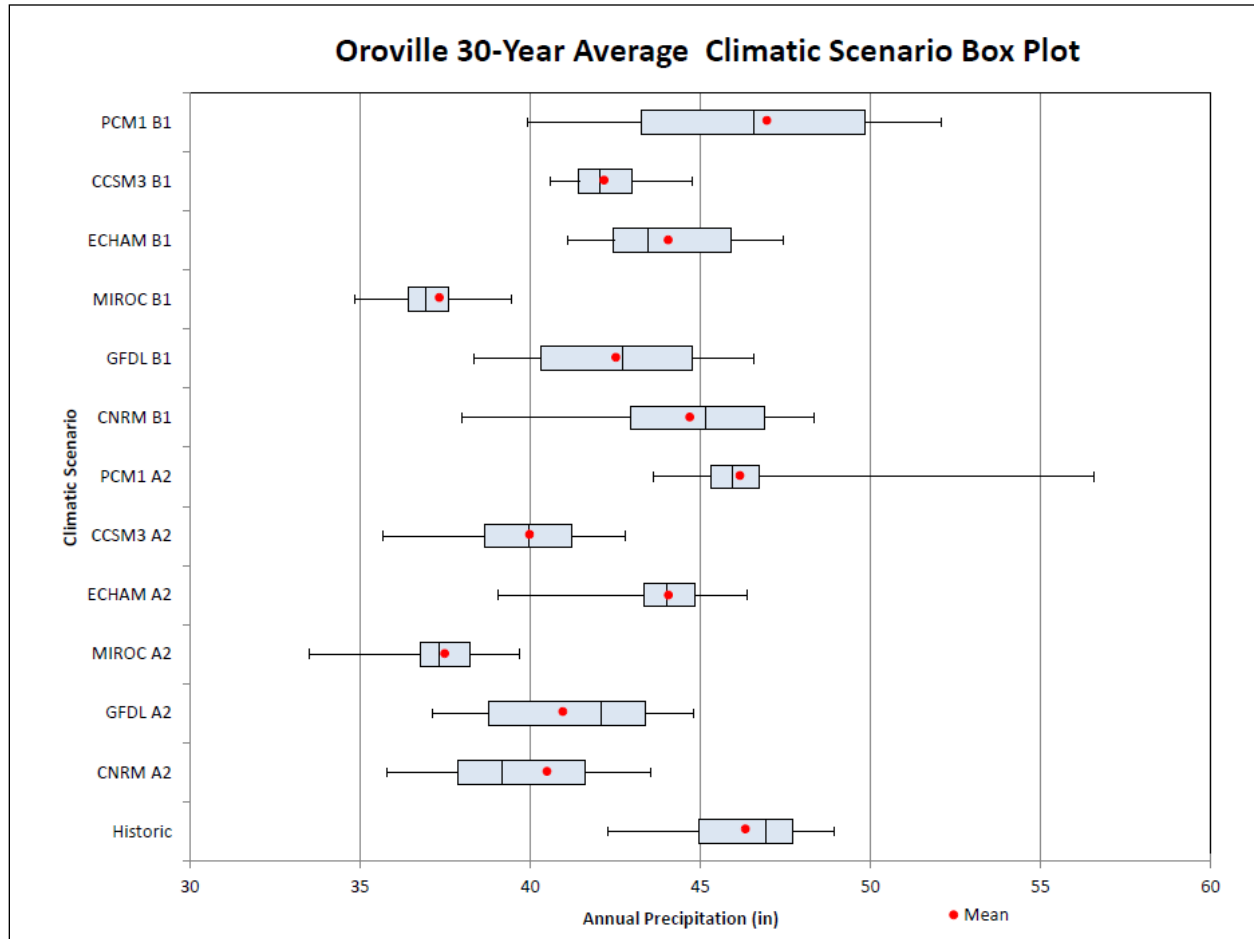


Figure 5-3 Variation in 30-Year Running Average Precipitation for Historical Record (1915-2003) and Alternative Scenarios of Future Simulated Climate (2011-2099) for Fresno

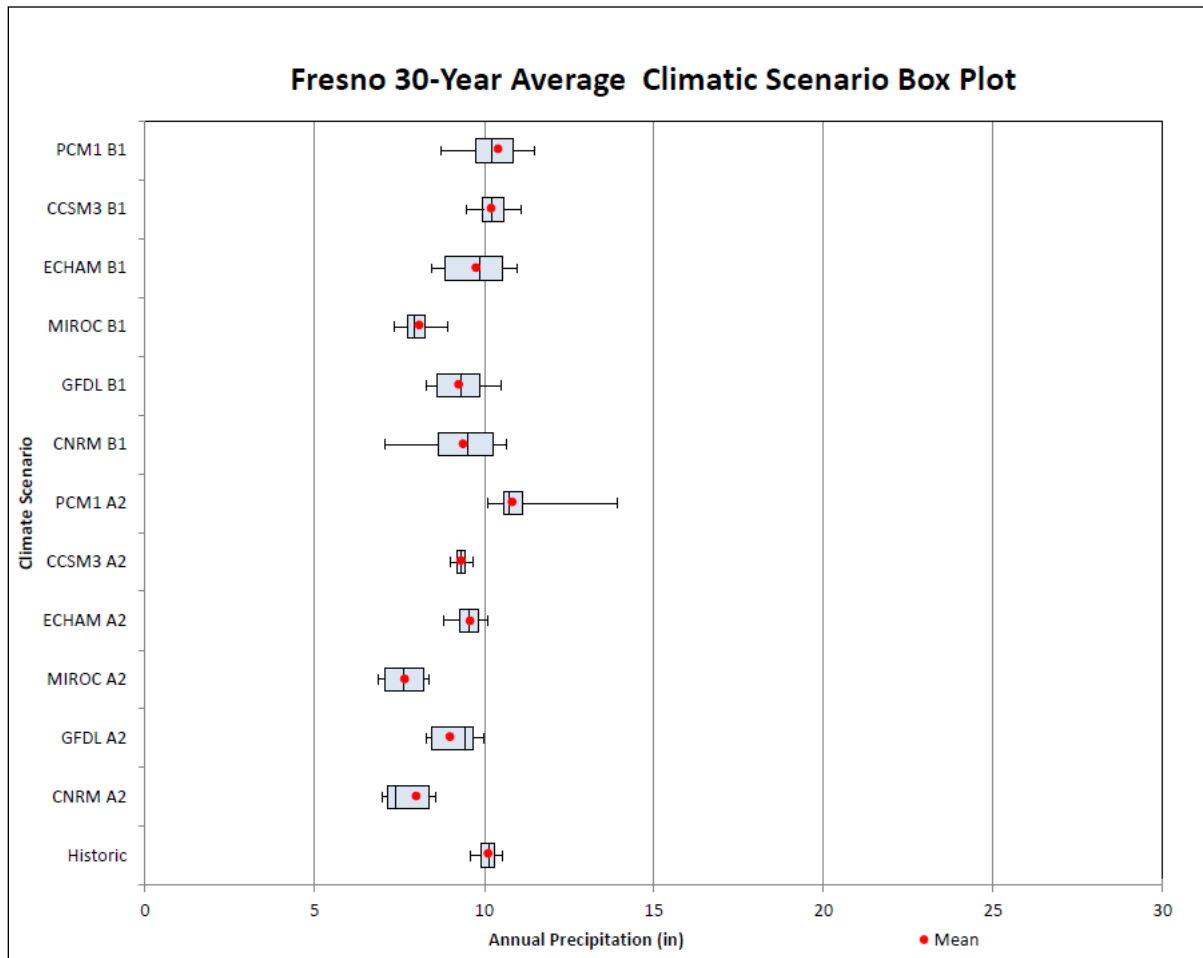


Figure 5-4 Variation in 30-Year Running Average Precipitation for Historical Record (1915-2003) and Alternative Scenarios of Future Simulated Climate (2011-2099) for Millerton

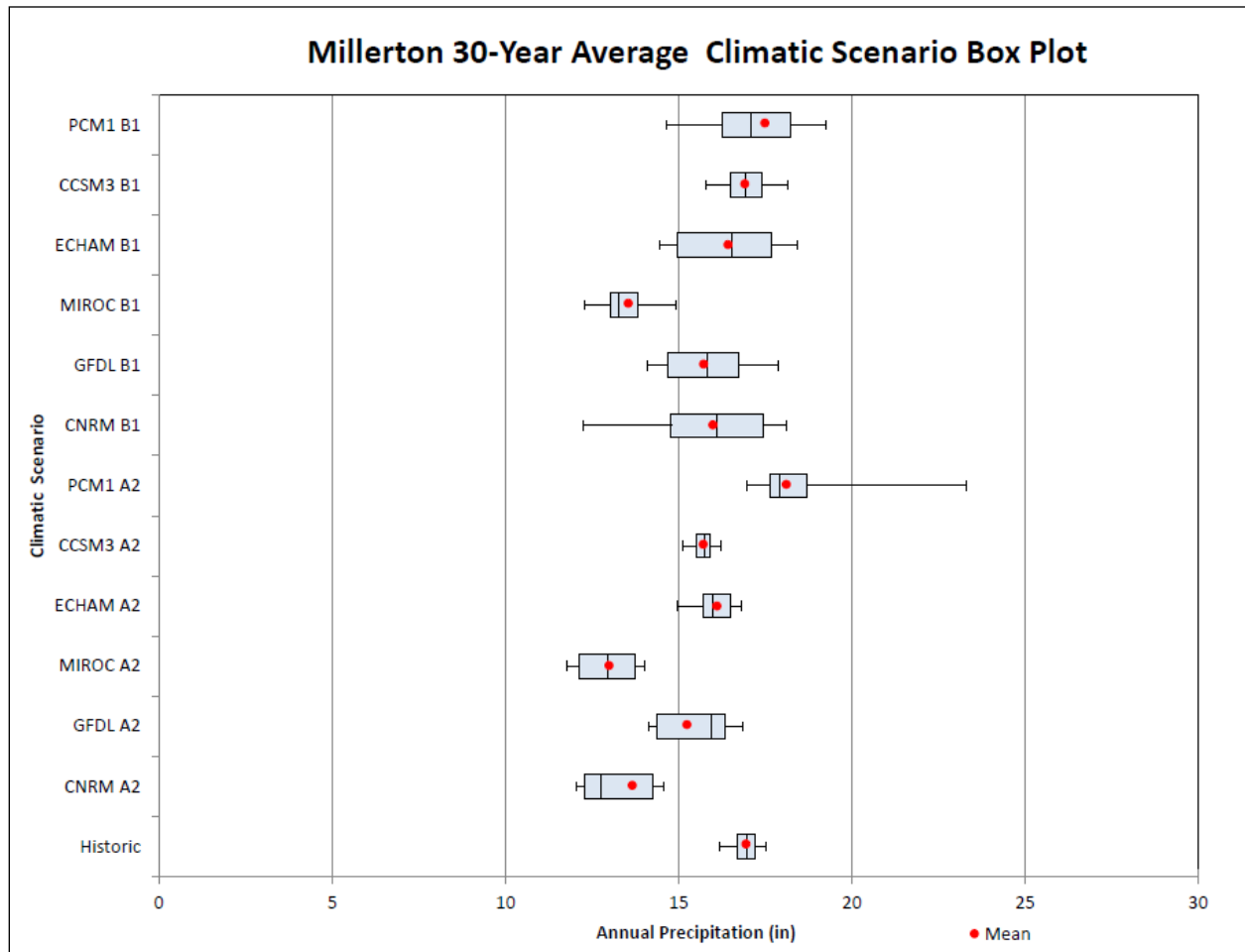
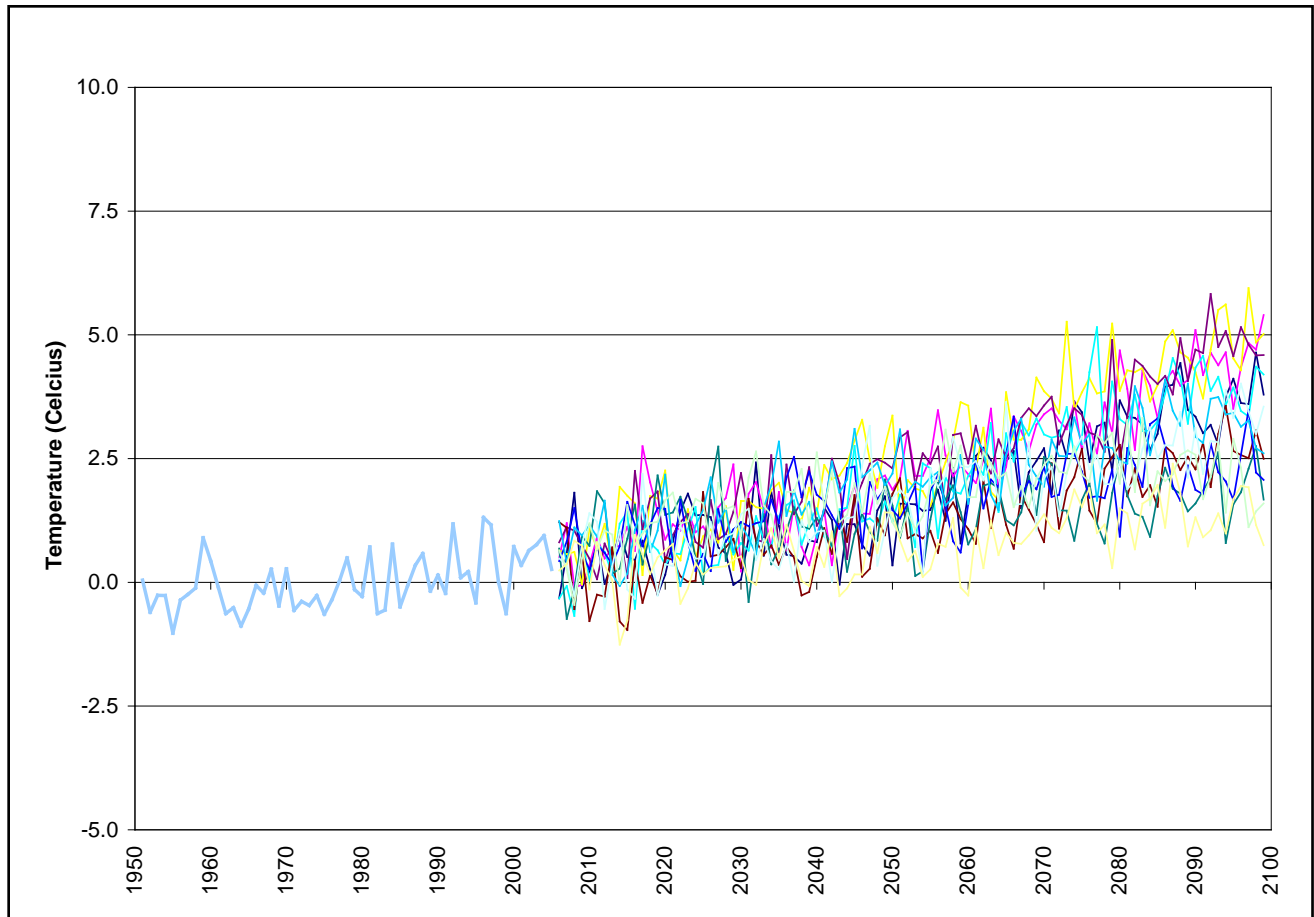


Figure 5-5 Change in Average Annual Temperature from Historical 1951-2005 Average for Historical Period and 12 Scenarios of Future Climate Years 2006-2100 for Sacramento Valley Floor

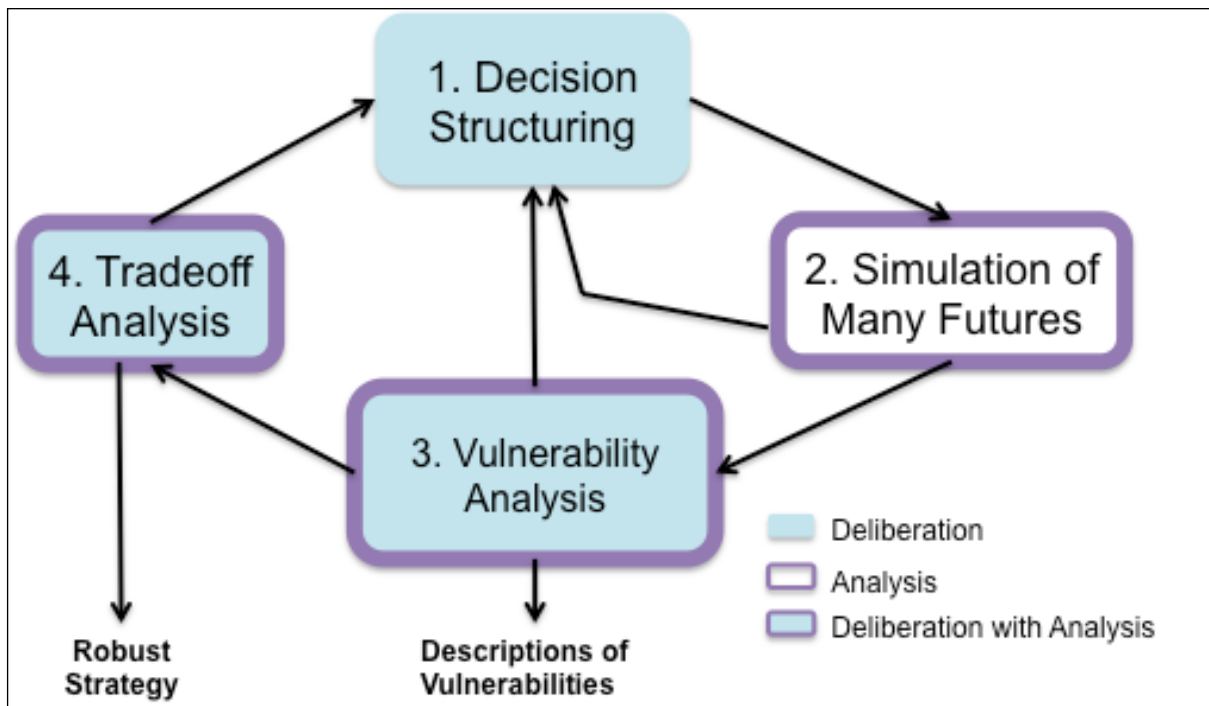


Note: In this figure, historical period shows actual demand (blue line). Each colored line represents 1 of 12 climate scenarios.

Figure 5-6 California Hydrological Regions Highlighting Three Central Valley Regions Used in Test Case



Figure 5-7 Robust Decision-Making Steps Used in Water Plan Analysis



Source: Lempert et al. 2013

Figure 5-8 Single Simulation of Agricultural Supply, Demand, and Unmet Demand for the Sacramento River Hydrologic Region

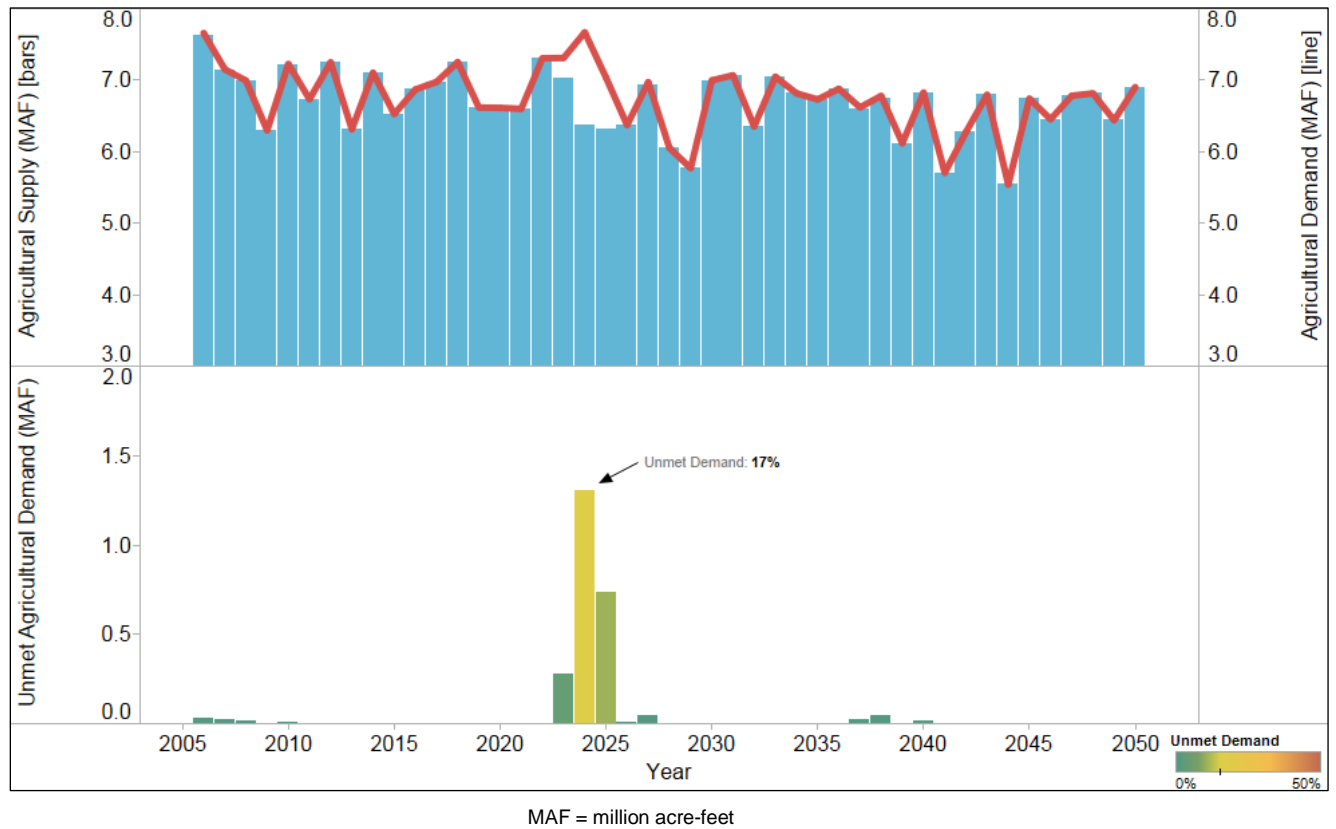
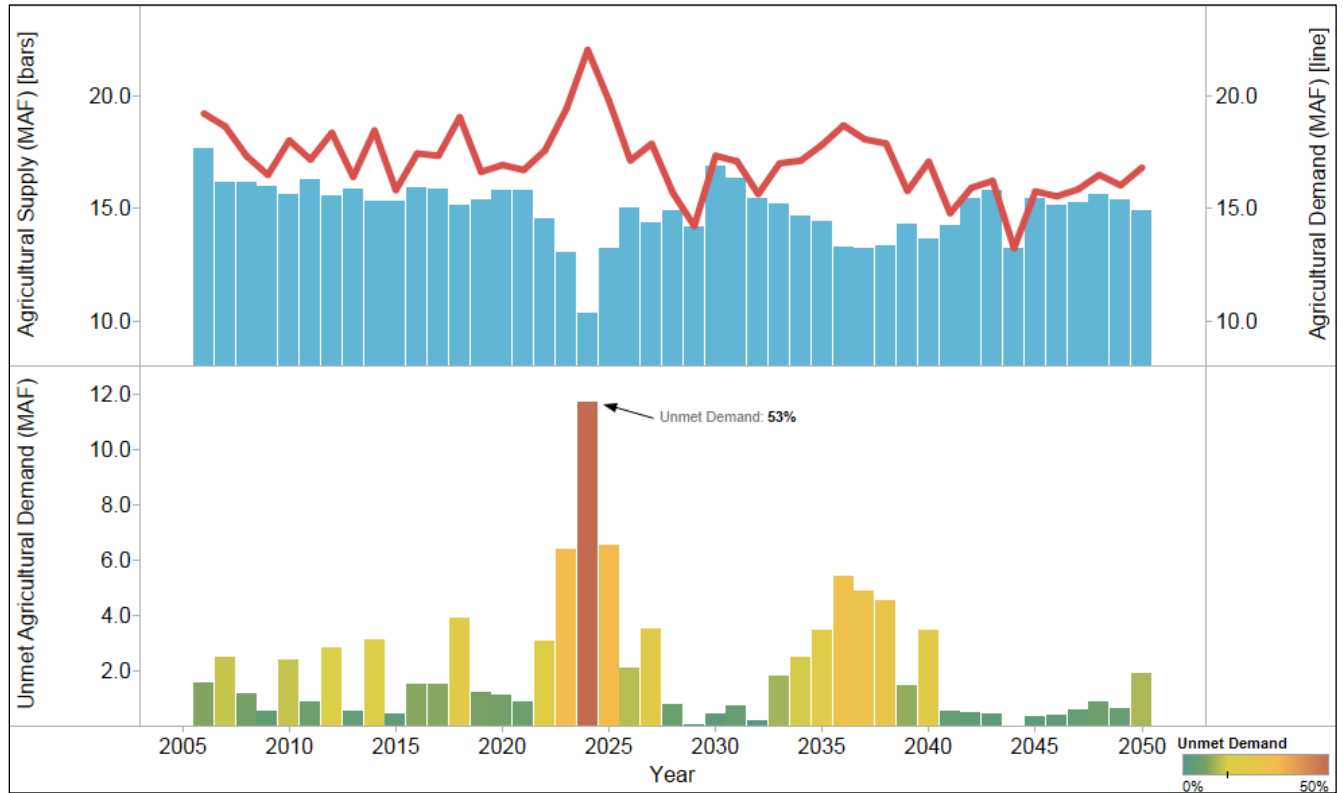


Figure 5-9 Single Simulation of Agricultural Supply, Demand, and Unmet Demand for the San Joaquin River and Tulare Lake Hydrologic Regions



MAF = million acre-feet

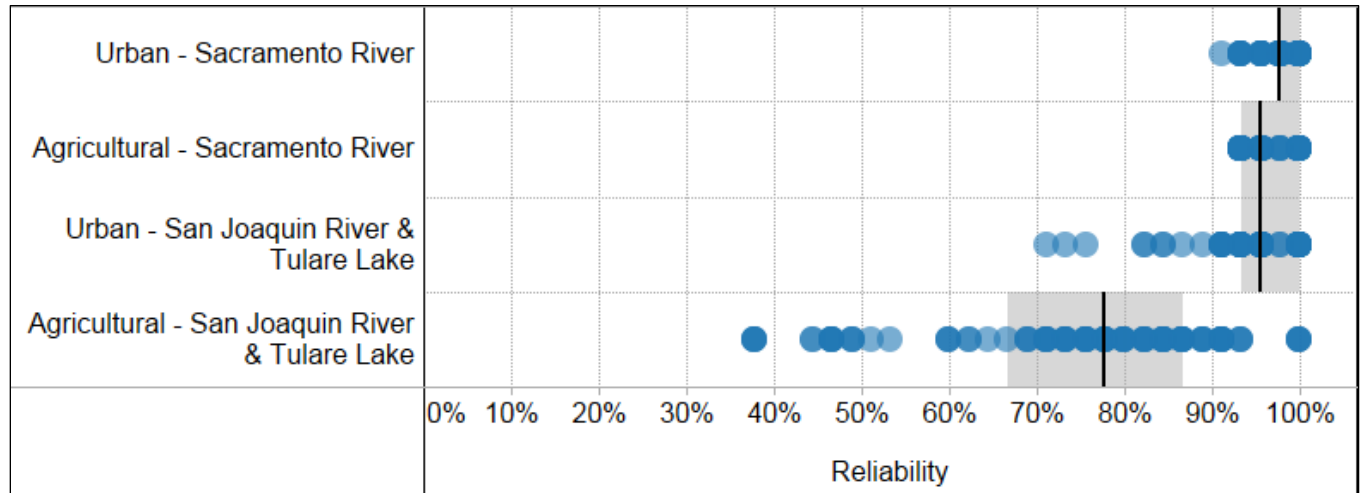
Figure 5-10 Range of Urban and Agricultural Reliability Results Across Futures

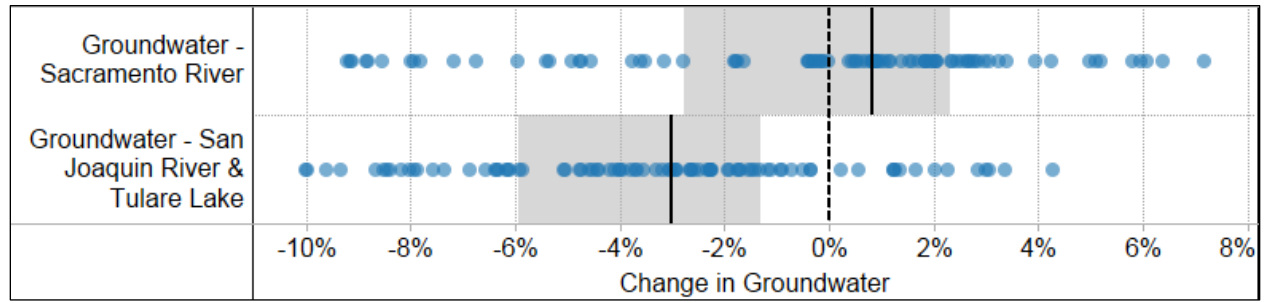
Figure 5-11 Range of Groundwater Storage Changes Across Futures

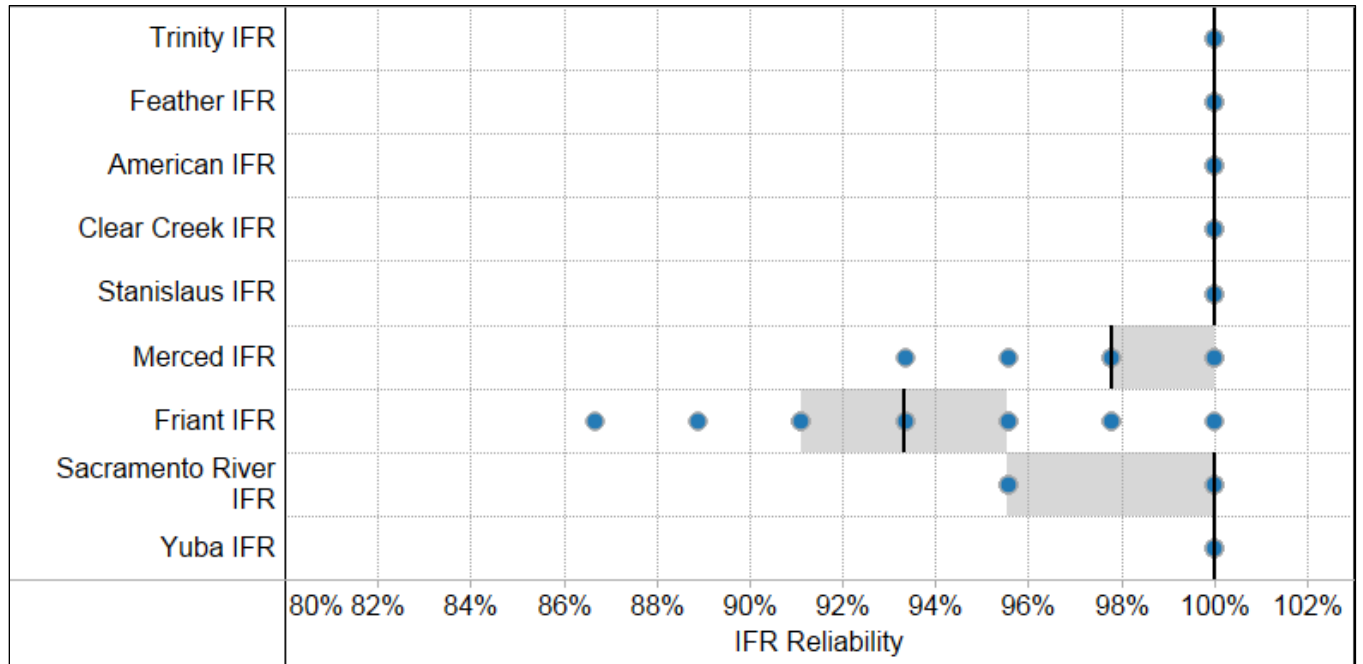
Figure 5-12 Range of Instream Flow Requirement Reliability Across Futures

Figure 5-13 Climate Conditions Leading to Low Urban Reliability in the San Joaquin River and Tulare Lake Hydrologic Regions for the Low-Population and High-Density Land Use Scenario

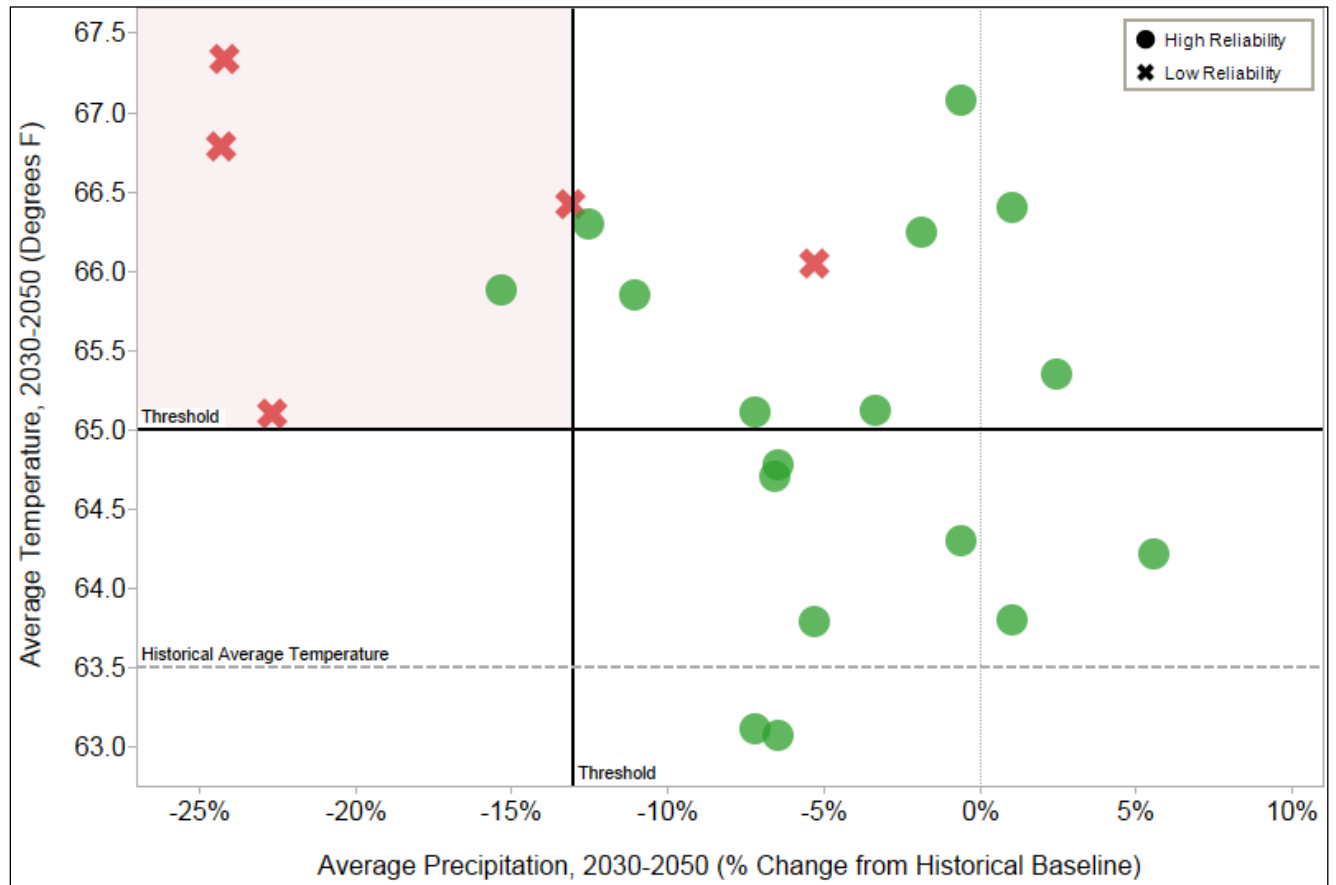


Figure 5-14 Climate Conditions in the San Joaquin River and Tulare Lake Hydrologic Regions Leading to Low Urban Water Reliability for the High-Population and Low-Density Land Use Scenario for Three Sets of Climate Scenarios

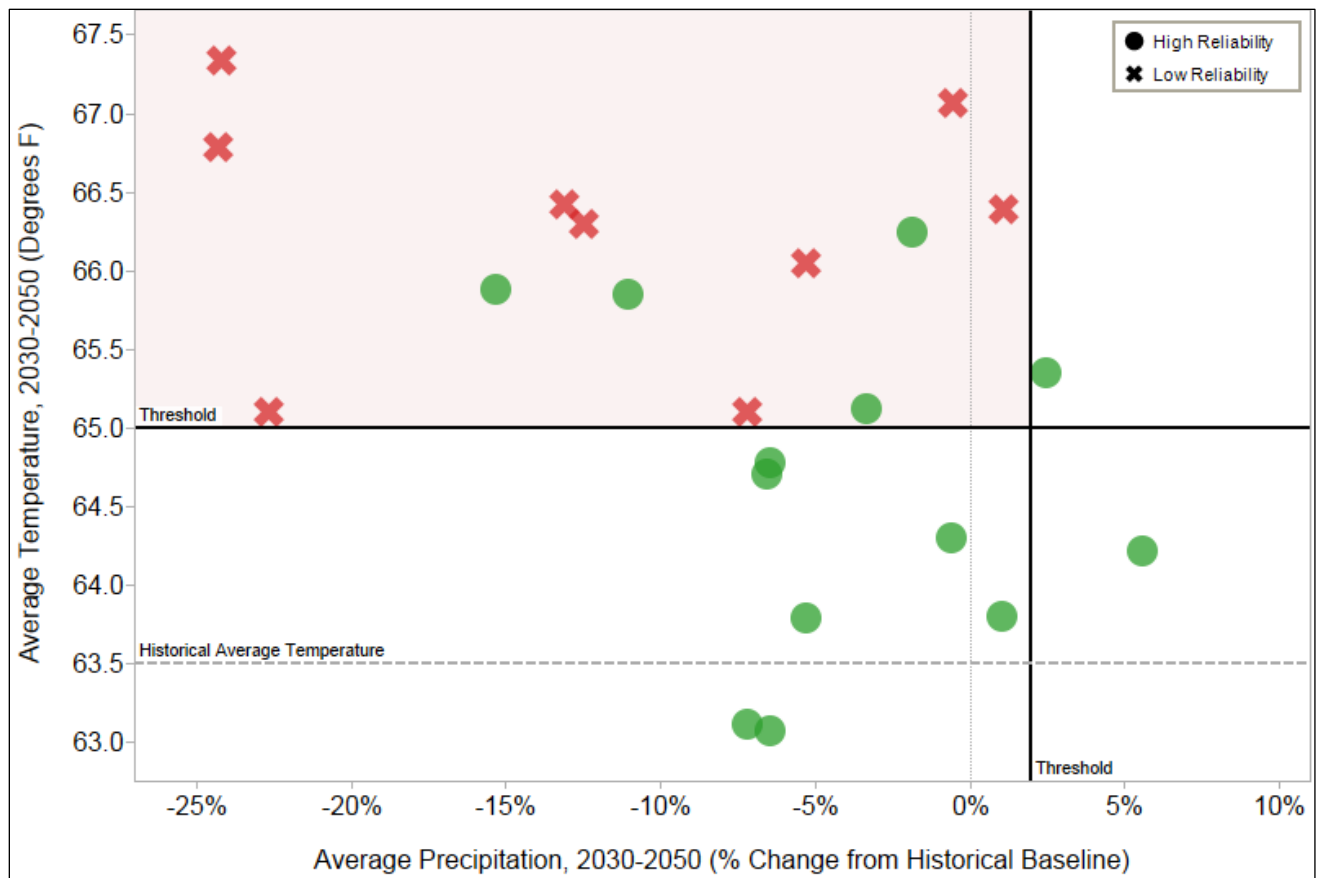


Figure 5-15 Climate Conditions Leading to Low Agricultural Reliability Results in the San Joaquin River and Tulare Lake Hydrologic Regions

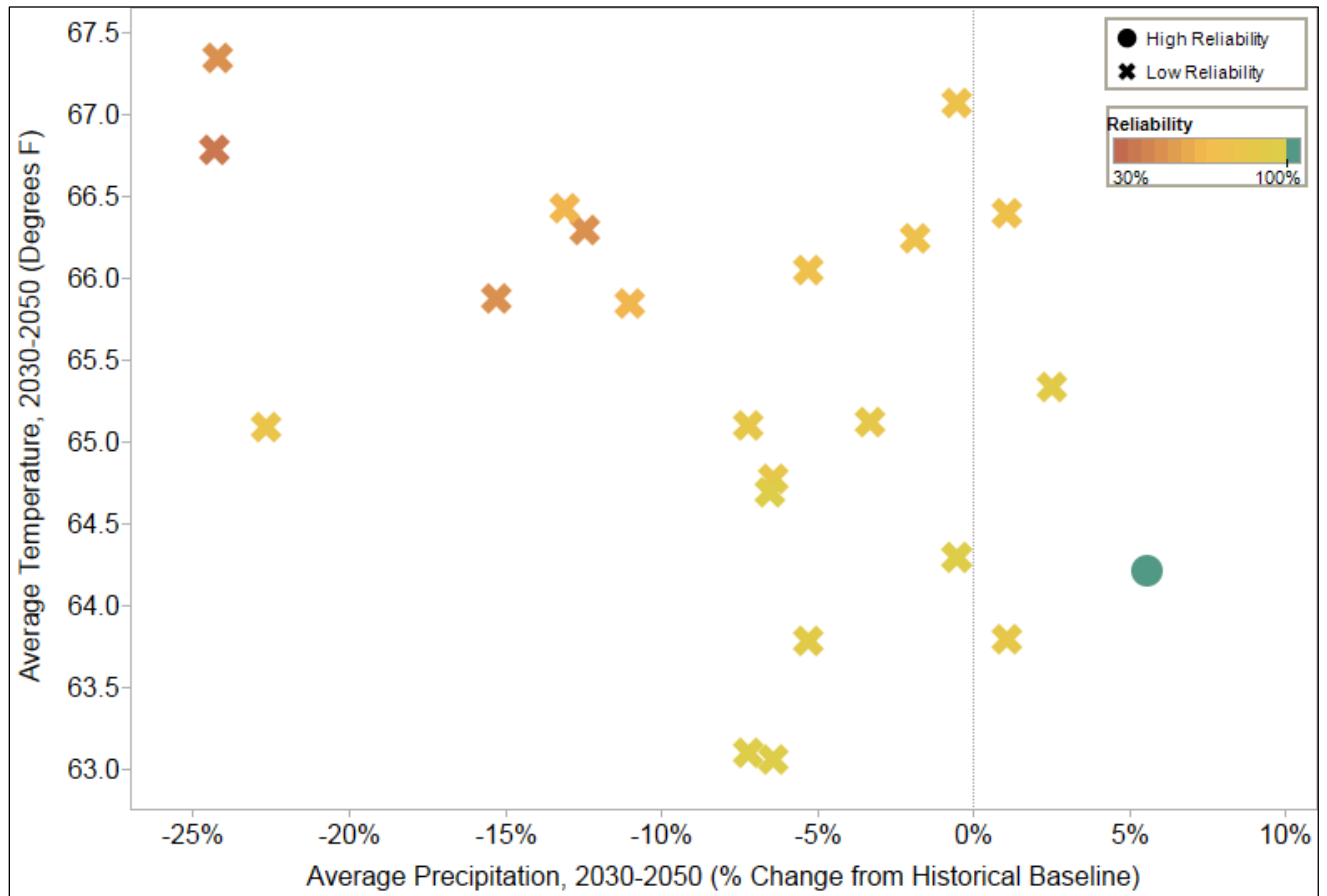


Figure 5-16 Tradeoff between Vulnerability Reduction and Cost of Example Response Packages from Proof-of-Concept Analysis

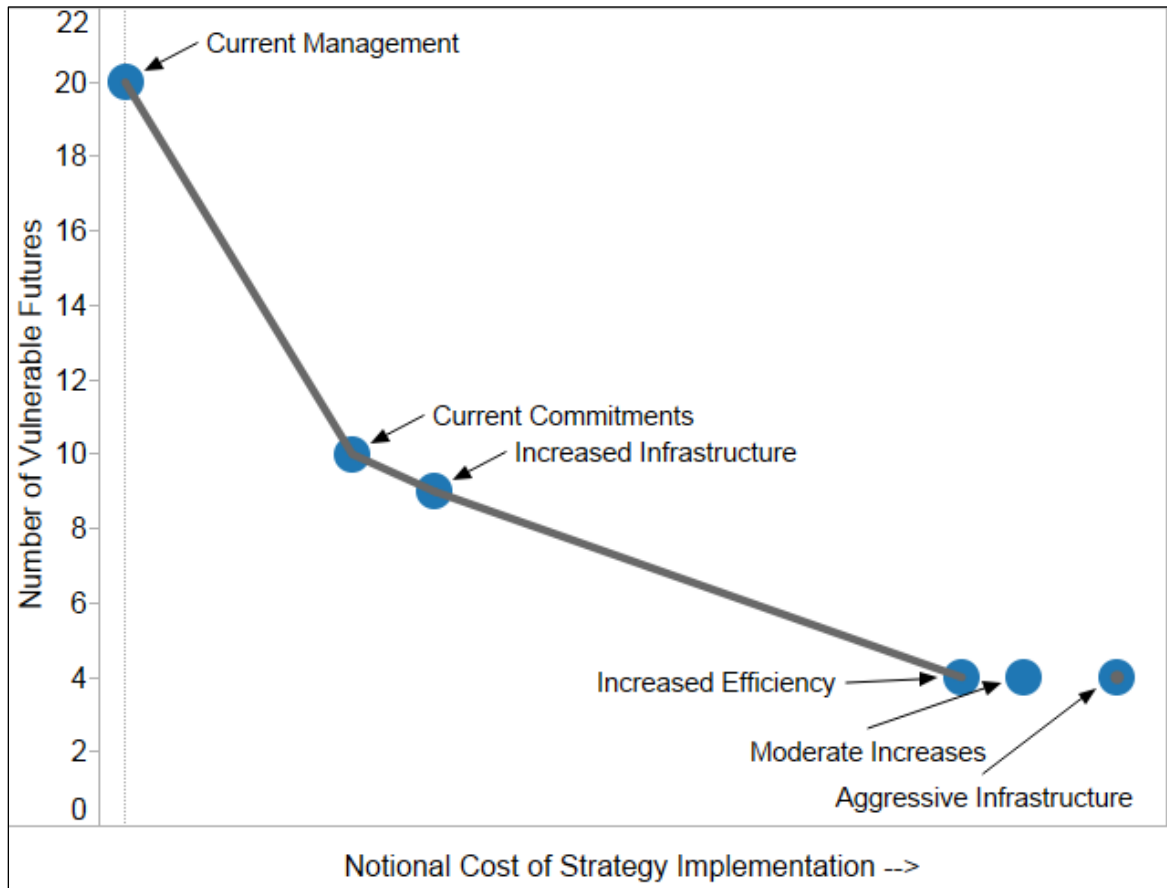
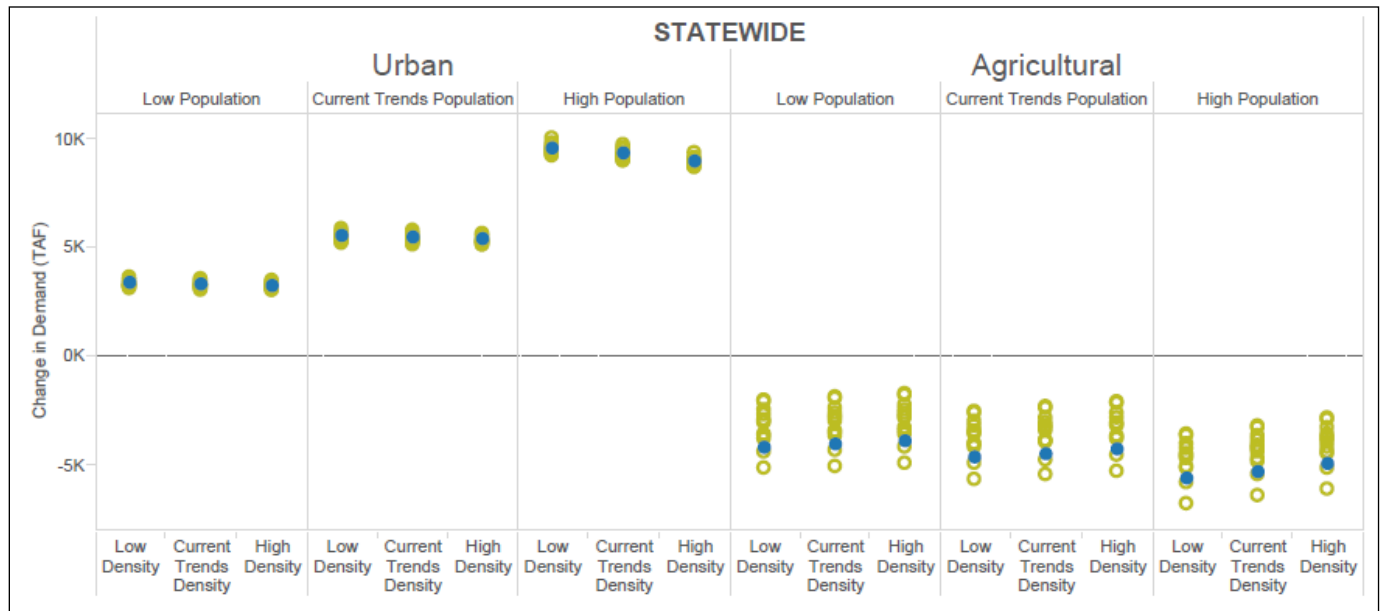


Figure 5-17 Change in Statewide Agricultural and Urban Water Demands for 117 Scenarios from 2006-2005 (million acre-feet per year)



Climate



Figure 5-18 Change in Regional Agricultural and Urban Water Demands for 117 Scenarios from 2006-2005 (million acre-feet per year)

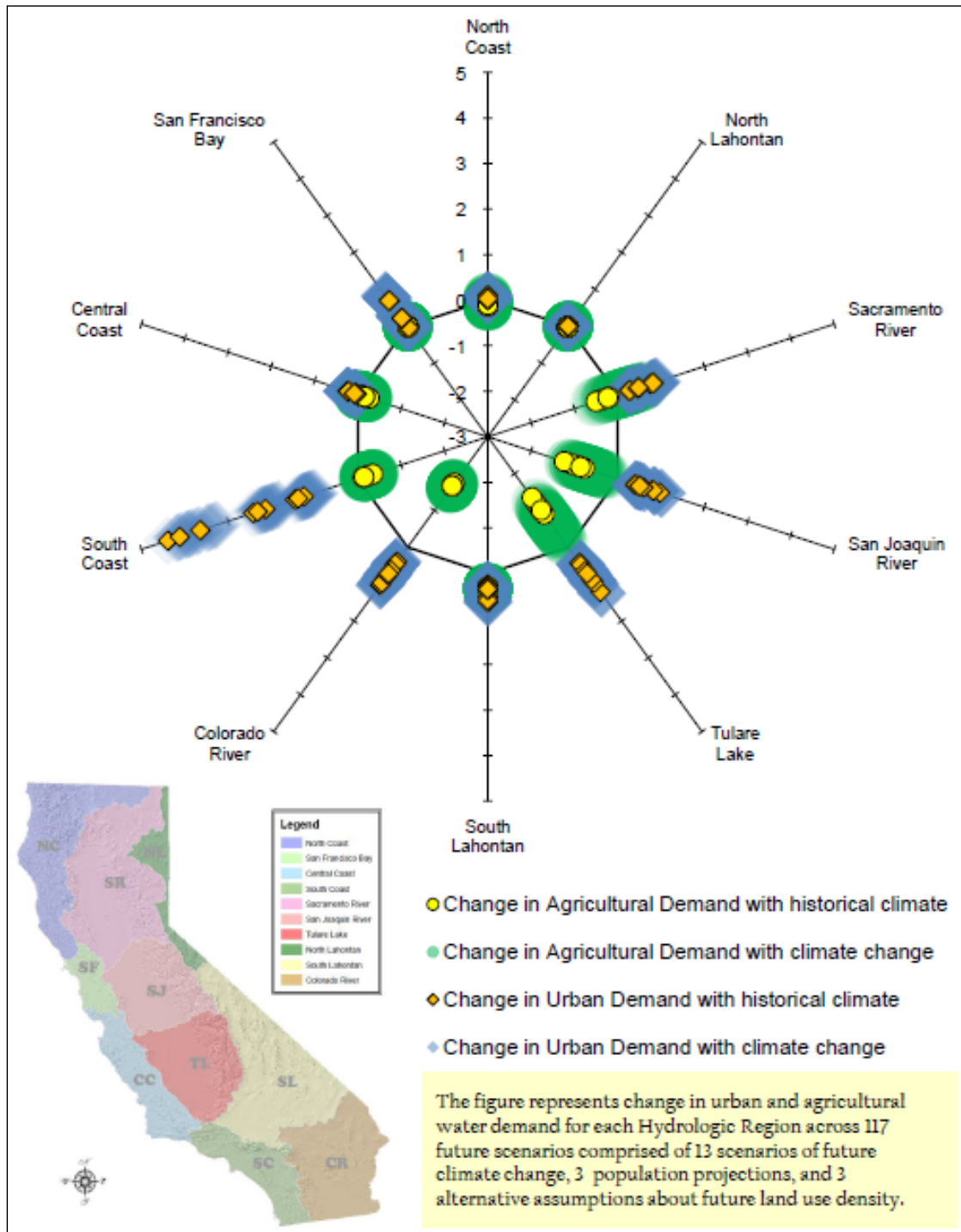


Figure 5-19 The California Water Sustainability Indicators Framework – Process

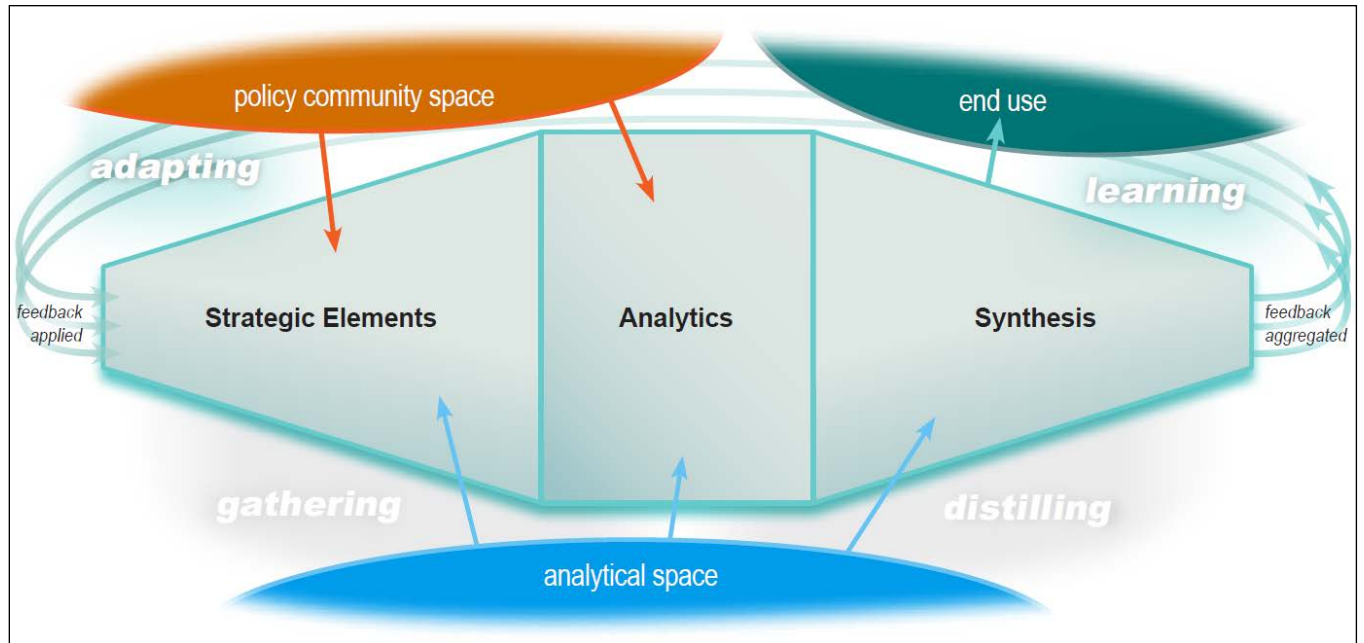


Figure 5-20 Details of the California Water Sustainability Indicators Framework

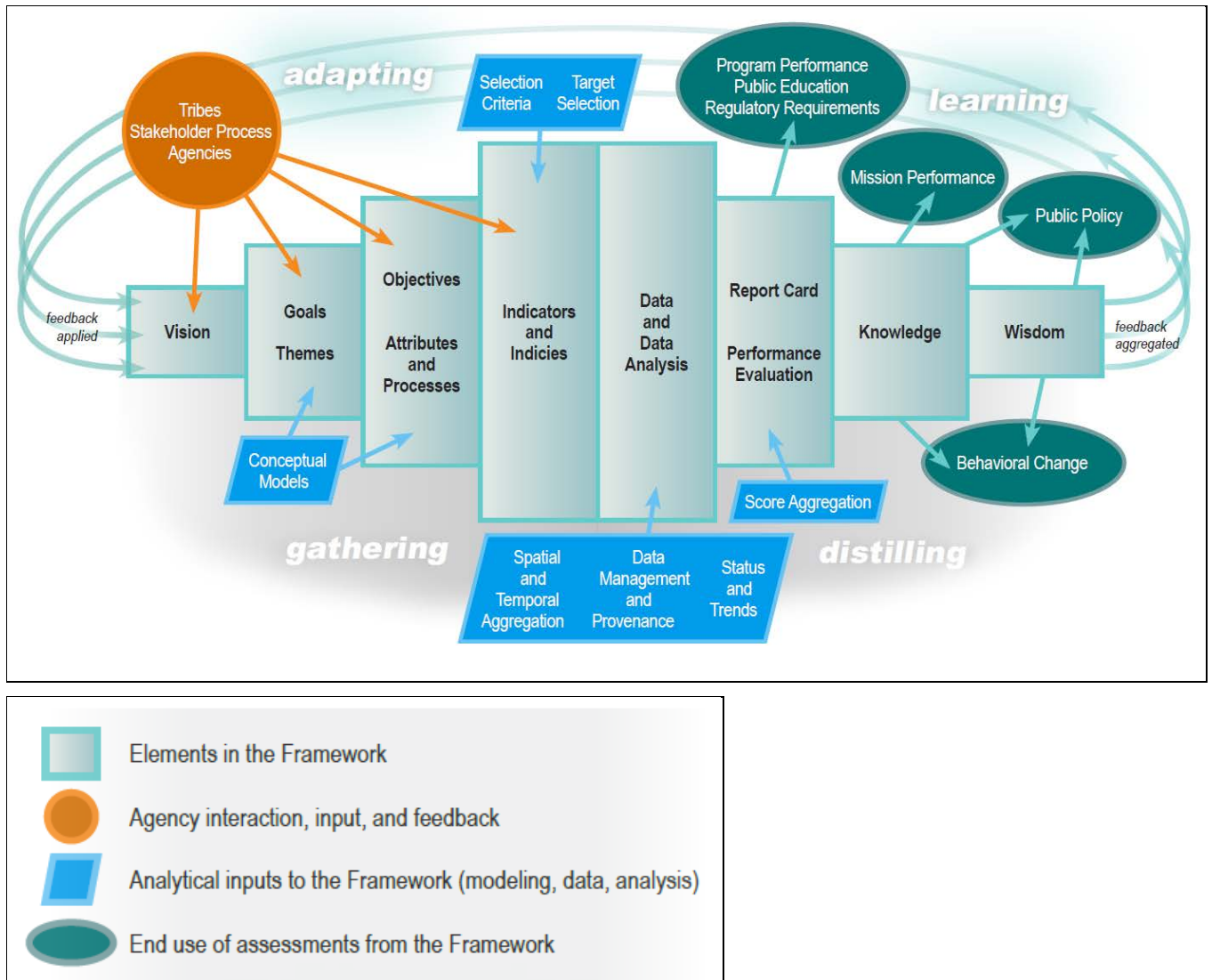


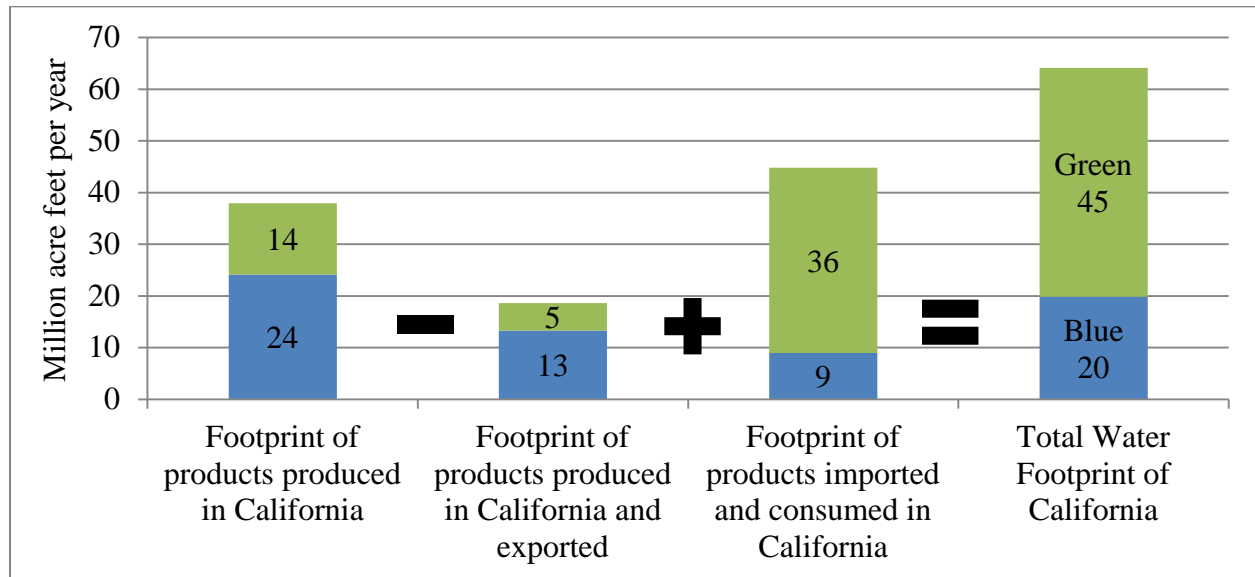
Figure 5-21 California's Blue and Green Water Footprint

Figure 5-22 Impervious Cover: Water Quality Index

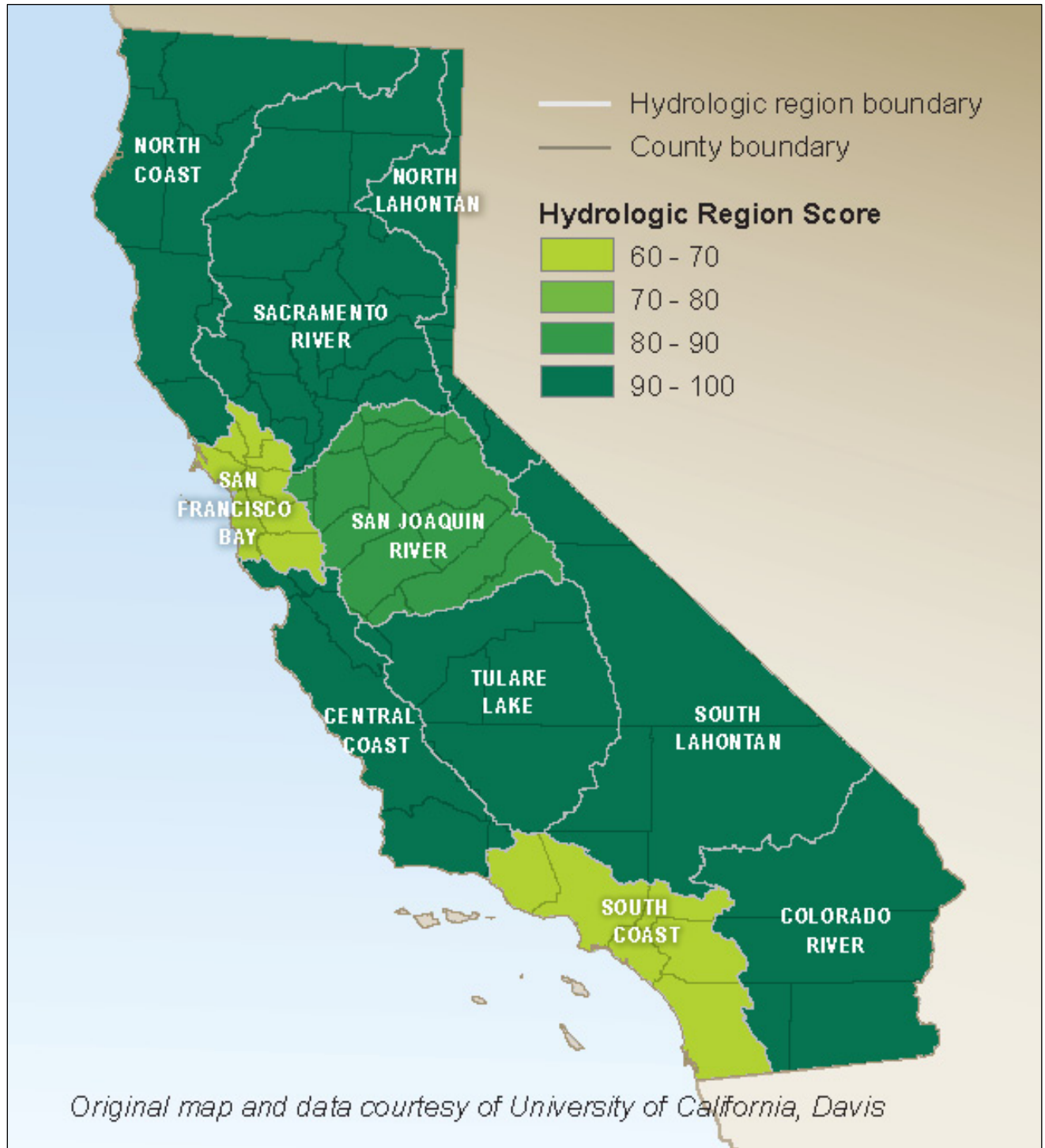


Figure 5-23 Impervious Cover: Geomorphic Processes



Figure 5-24 California Stream Condition Index

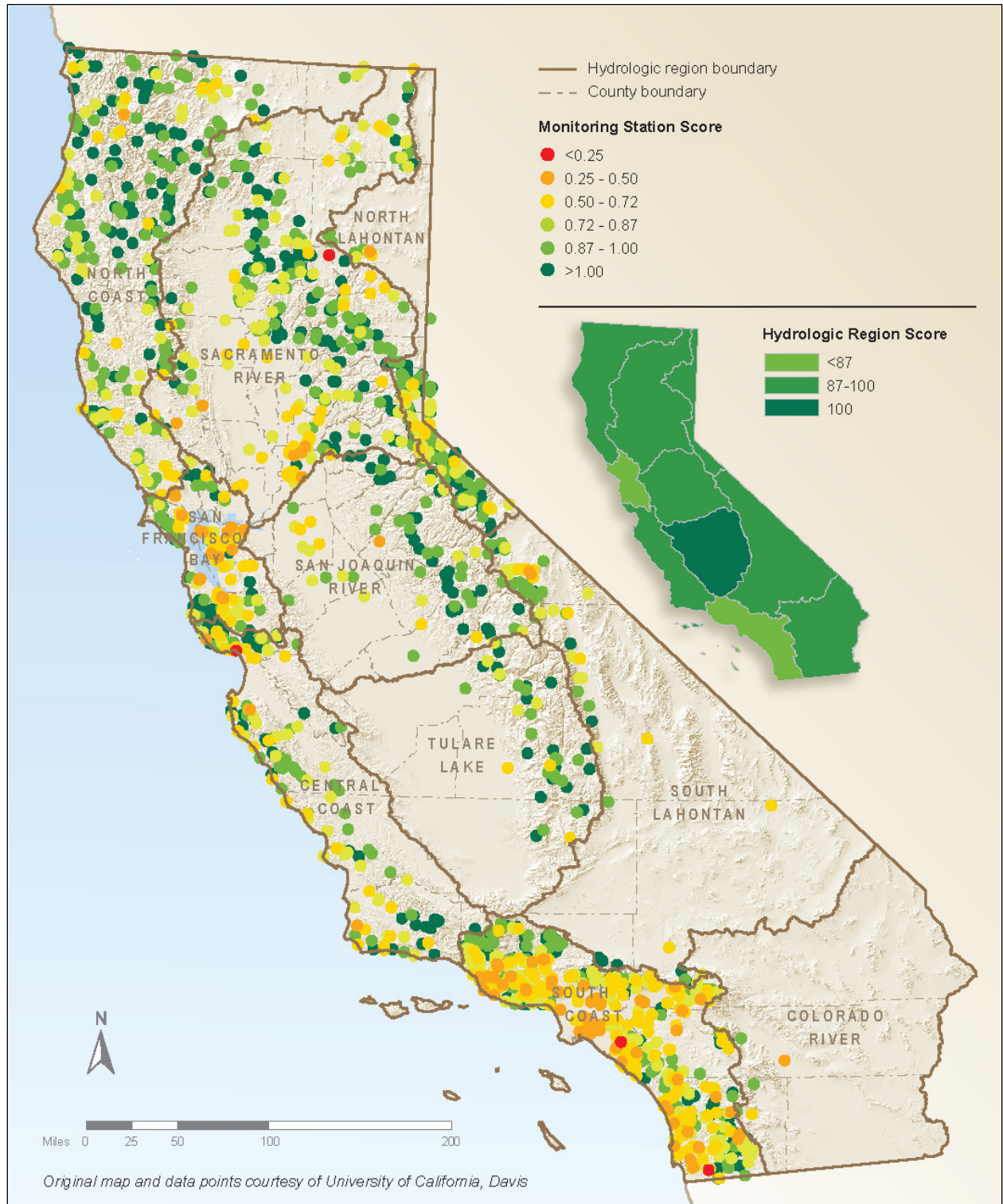


Figure 5-25 Fish Community Score for Hydrologic Regions

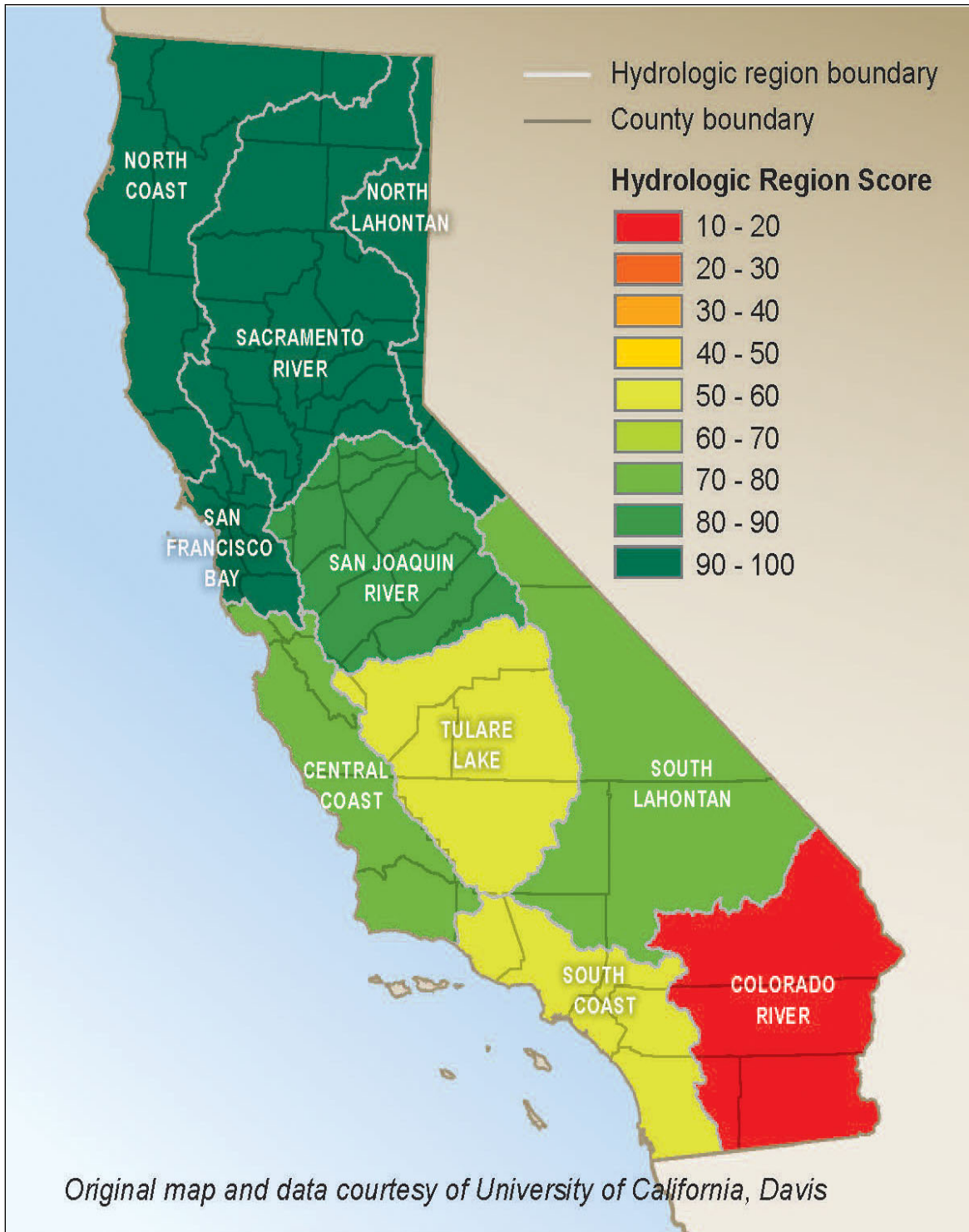
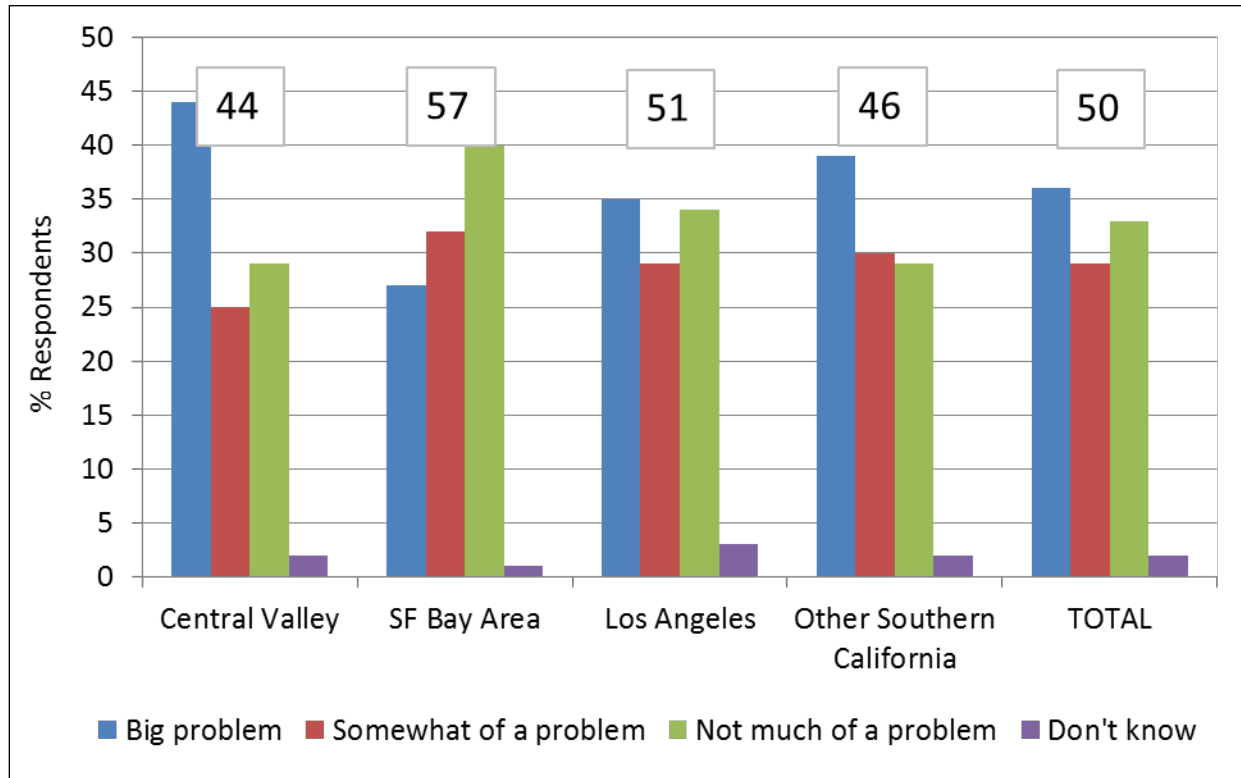
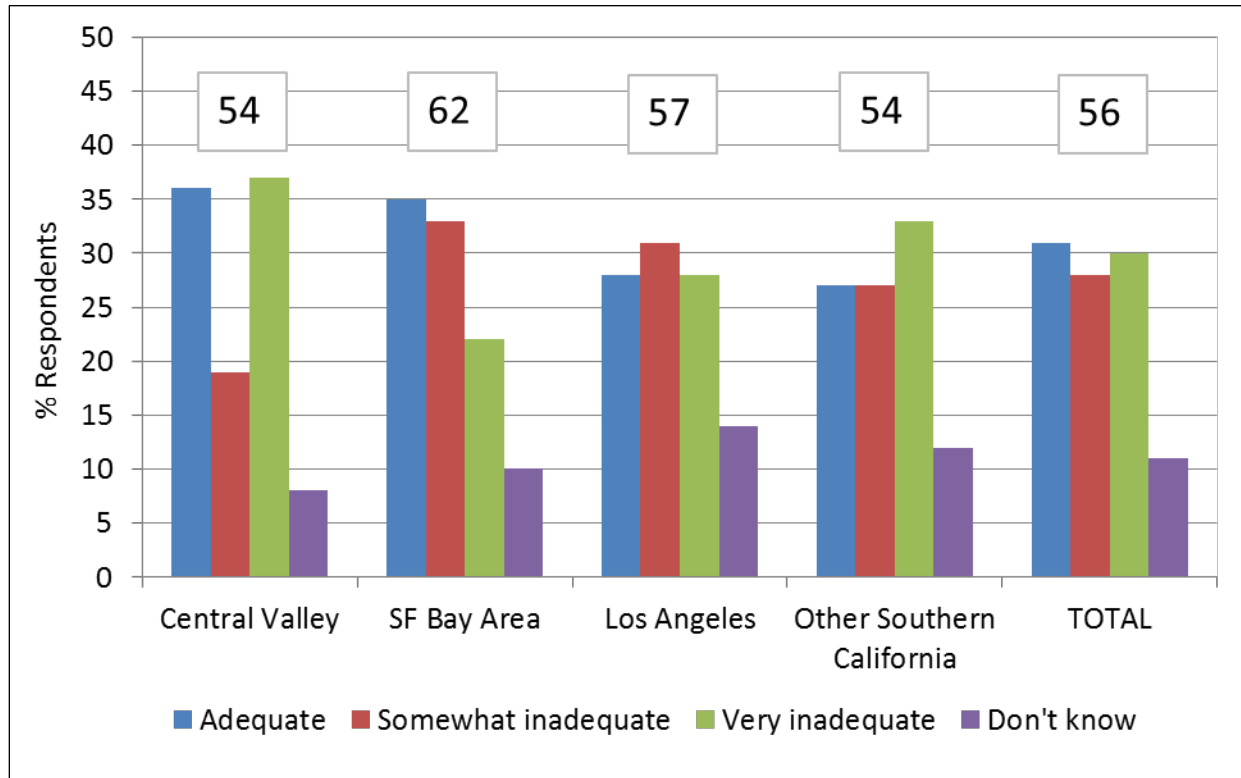
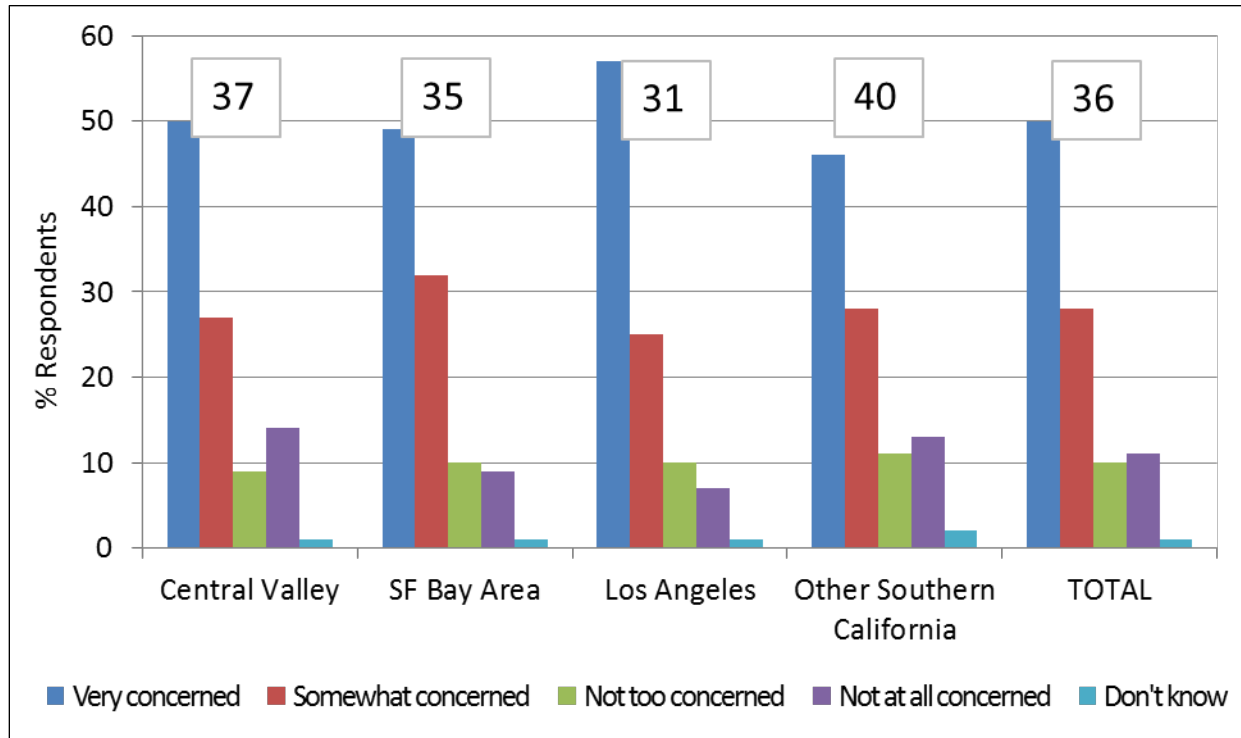


Figure 5-26 Public Perception by Region of Seriousness of Threats to the Public Water Supply

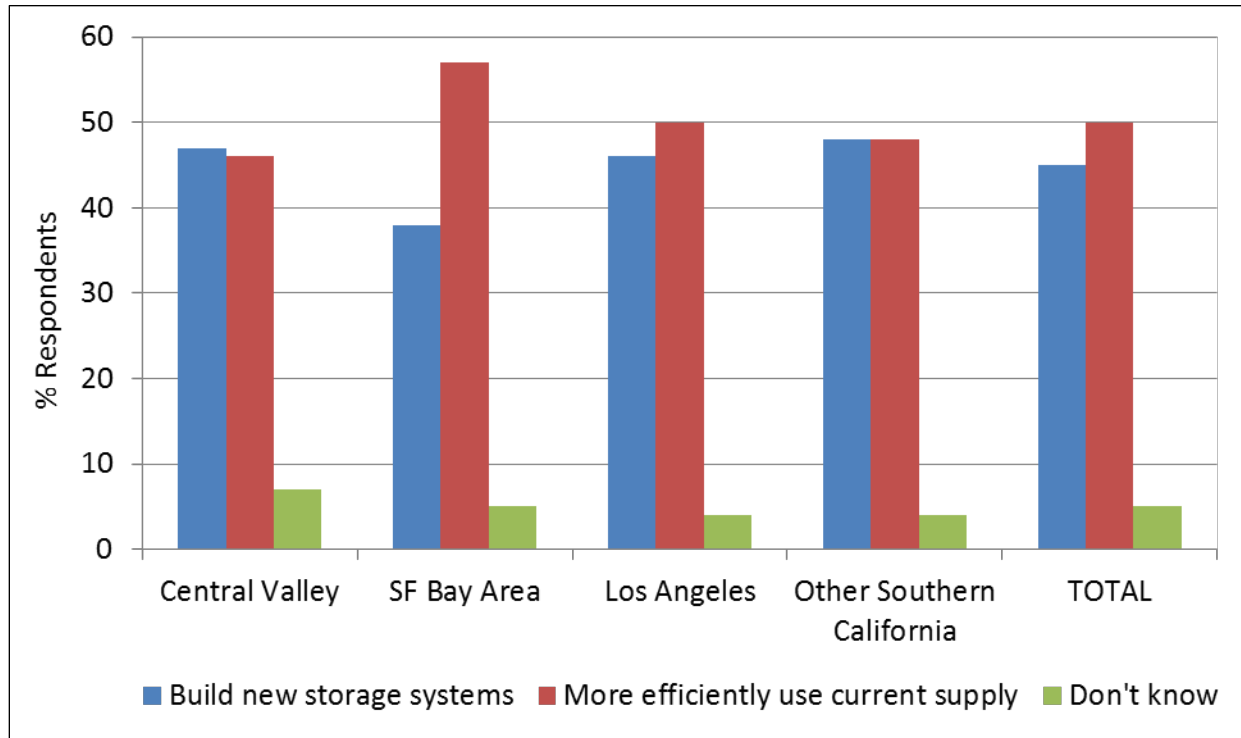
Notes: December 2012, sample = 7,315 respondents. Scores are shown in boxes above each regional summary.

Figure 5-27 Public Perception of Security of Future Water Supplies

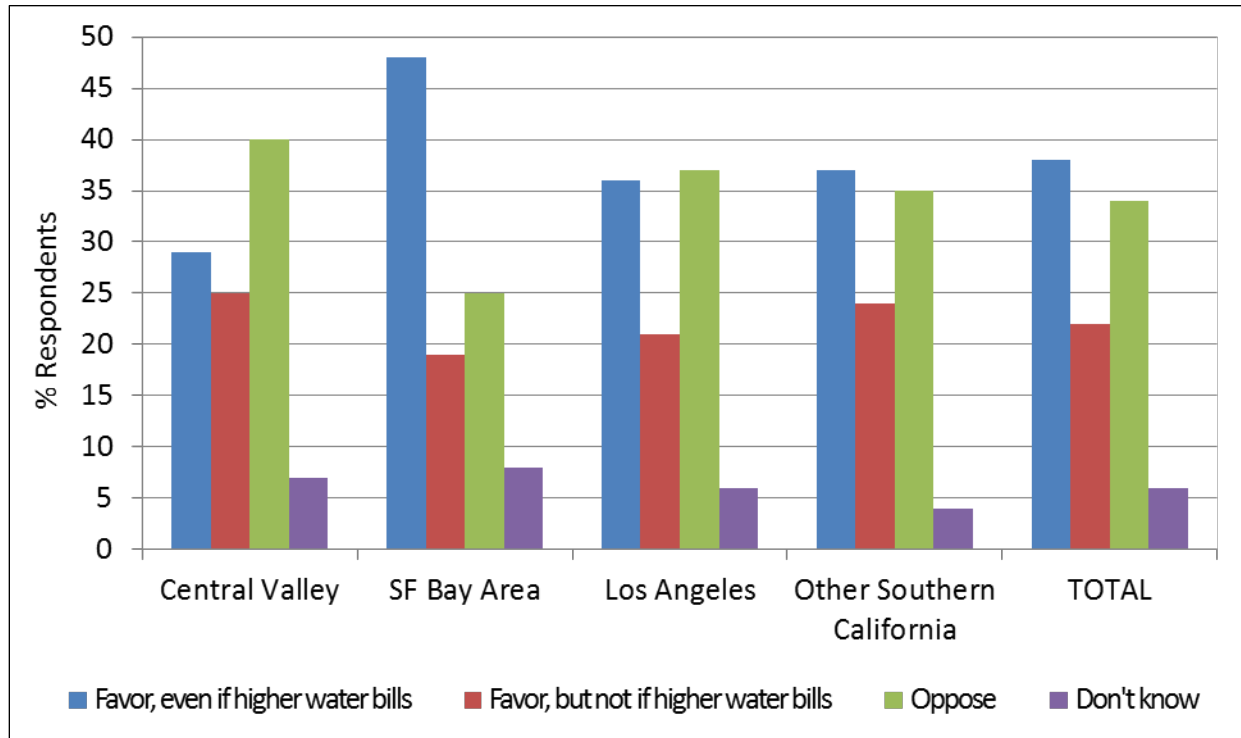
Notes: December 2009, sample = 1,825 respondents. Scores are shown in boxes above each regional summary.

Figure 5-28 Public Perception of Effects of Climate Change on Future Water Supplies

Notes: July 2011, sample = 4,580 respondents. Scores are shown in boxes above each regional summary.

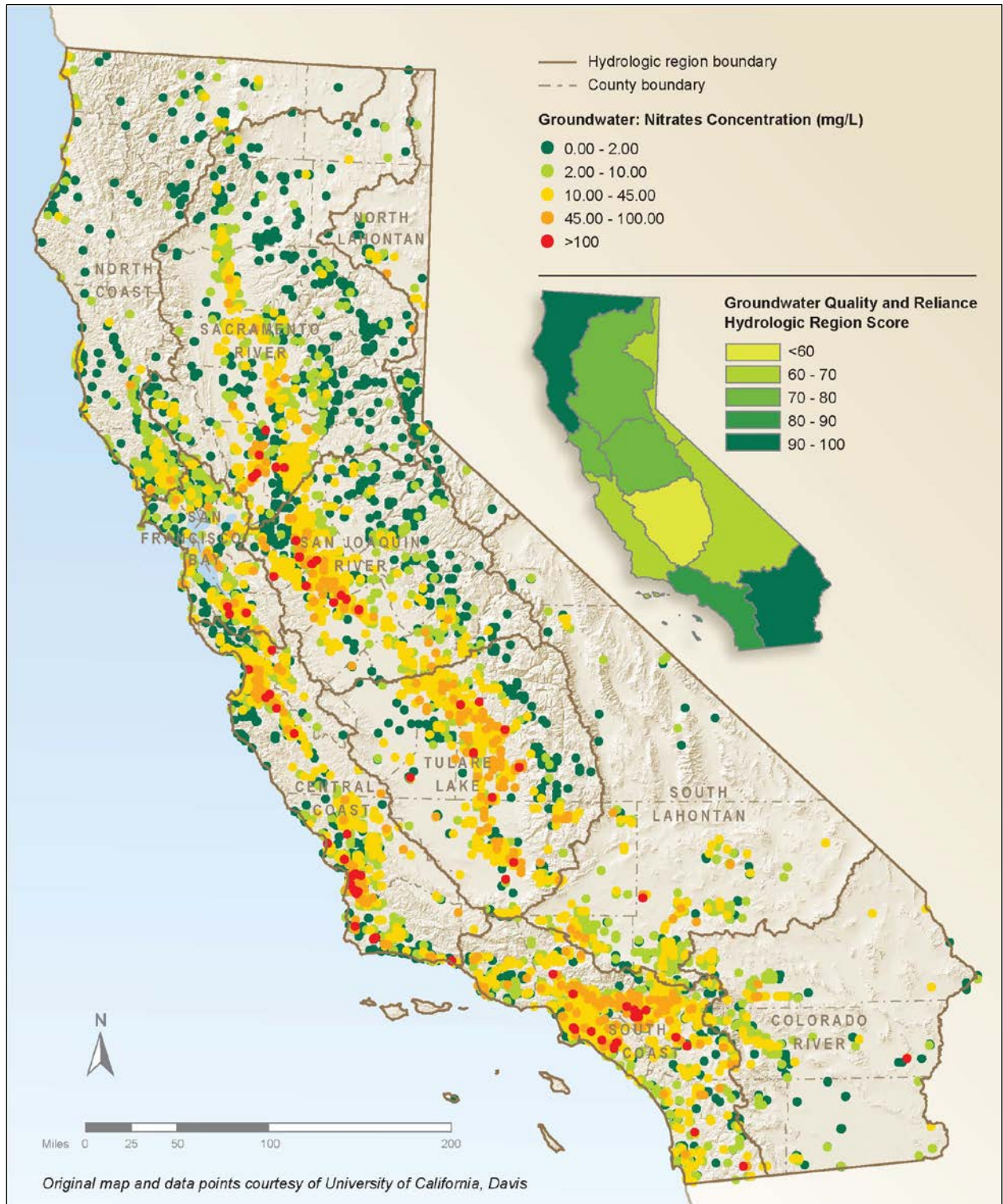
Figure 5-29 Public Perception of Future Water Management Strategies to Maintain Water Supply

Notes: December 2012, sample = 3,904 respondents.

Figure 5-30 Public Favor for Improving Conditions for Fish, Including Payment Strategies

Notes: December 2012, sample = 1,833 respondents.

Figure 5-31 Groundwater and Drinking Water Contamination Score for Hydrologic Regions



Box 5-1 Uncertainty, Risk, and Sustainability

Uncertainty. Uncertainty is what we do not know about the system. For example, engineers do not know the foundation conditions under all California levees. Uncertainty can be reduced by reducing data gaps to increase knowledge.

Risk. Most risks originate from such hazards as floods, earthquakes, and droughts that would occur even if all uncertainty could be eliminated. Reducing uncertainty provides a clearer view of what the risks to the system are.

Risk is the probability of the occurrence (multiplied by) consequences of the occurrence over a range of potential events.

Sustainability. A sustainable system or process has longevity and resilience. A sustainable system manages risk but cannot eliminate it. A sustainable system generally provides for the economy, the ecosystem, and social equity. Water sustainability is the dynamic state of water use and supply that meets today's needs without compromising the long-term capacity of the natural and human aspects of the water system to meet the needs of future generations. For example, planning ways to eventually eliminate drafting more groundwater than can be recharged over the long term is one approach for improving sustainability.

Box 5-2 Sources of Future Change and Uncertainty

Sources of Gradual or Long-term Change and Uncertainty

Urban Land Use (population). Projecting future changes in population, development patterns, changes in runoff and infiltration with increased impervious area, and changes in water quality impacts becomes more uncertain with the time frame of the projection.

Agricultural Land Use. Agricultural water use is influenced by land conversions to urban or ecosystem uses, but also depends on cropping patterns driven by water availability and the world economy.

Other Land Use. Conversions of land to ecosystem or other uses can change water use, water quality, ecosystem health, and many other factors. Some ecosystem uses consume more water per acre than agricultural and urban uses.

Climate Change. The changing climate presents many uncertainties in the magnitude, pattern, and the rate of potential change:

- **Snowpack.** California's snowpack, a major part of annual water storage, is decreasing with increasing winter temperatures.
- **Hydrologic Pattern.** Warmer temperatures and decreasing snowpack cause more winter runoff and less spring/summer runoff.
- **Rainfall Intensity.** Regional precipitation changes remain difficult to determine, but larger precipitation events could be expected with warmer temperatures in some regions.
- **Sea Level Rise.** Sea level rise is increasing the threat of coastal flooding, salt water intrusion, and even disruption of water exports from the Sacramento-San Joaquin Delta (Delta) should levees fail on key islands and tracts.
- **Water Demand.** Plant evapotranspiration increases with increased temperature.
- **Aquatic Life.** Higher water temperatures are expected to have a negative effect on some species and may benefit species that compete with native species.
- **Greenhouse Gas Emissions — Carbon Intensity or Carbon Footprint.** Storage, transport, and treatment of water involves the use of substantial amounts of energy, which in most cases result in the release of greenhouse gas emissions that contribute to climate change. Each water management strategy should be evaluated for its contribution to the accumulation of greenhouse gasses in our atmosphere.

Sources of Sudden or Short-term Change and Uncertainty

Delta Vulnerabilities. The Delta is highly susceptible to flooding and to disruption of significant water supply to many areas of the state.

Droughts. The severity, timing, and frequency of future droughts are uncertain.

Floods. The severity, timing, and frequency of future floods are uncertain.

Earthquakes. Even though more is now known about earthquakes, their location, timing, and magnitudes can have various effects on water systems.

Facility Malfunction. Deferred maintenance and aging infrastructure can cause unexpected outages in portions of the system.

Chemical Spills. Chemical spills are unpredictable, but can cause disruption of surface water and groundwater supplies.

Intentional Disruption. Vandalism, terrorist acts, and even cyber threats can have serious potential impacts on the operational capability of water delivery and treatment systems.

Fire. Wildfire in local watersheds can change runoff characteristics and affect water quality for decades.

Economic disruption. Sudden changes in the economy influence the ability to pay for improvements to the water management system.

Changing Policies/Regulations/Laws/Social Attitudes. Some changes in policies, regulations, laws, and social attitudes may be gradual, but some may be sudden:

- **Endangered species.** New listings of endangered species can require significant changes to the operation of the water system and the distribution of water supplies among agricultural, urban, and environmental uses.
- **Plumbing Codes.** Future changes in plumbing codes, such as the one for installing ultralow-flow toilets, could allow use of innovative water fixtures to conserve water.
- **Emerging Contaminants.** The nature and impact of contaminants may be changing in the future, especially as new health and ecological risk information is obtained.

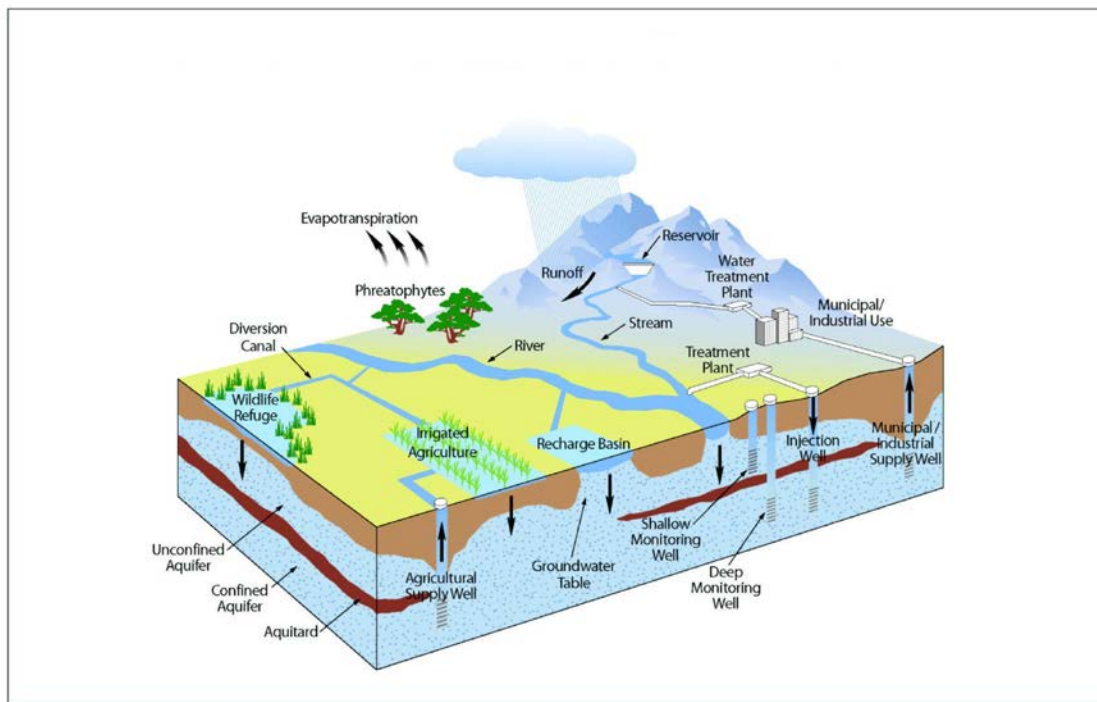
Box 5-3 Managing Floods versus Managing Flood Risk

Managing floods means building and operating facilities, such as dams, weirs, levees, and pump stations, to safely store and convey flood flows within designated channels to reduce the chance of flooding. Although such improvements can greatly reduce flood risk, they cannot entirely eliminate it. Subsequently, floodplains are often developed because of the perception that the chance of flooding has been eliminated. As a result, the overall flood risk (paradoxically) can increase following construction of flood control facilities. Flood risk is the combined effect of the chance of flooding and the property that would be damaged if flooded. Managing flood risk means either reducing the chance of flooding or the population and property exposed to flooding, or a combination of both. Thus, managing flood risk can include flood control facilities, as well as limiting floodplain development; elevating structures above flood elevations; creating natural flood storage and groundwater recharge areas; and using flood risk notification, flood insurance, and flood preparedness.

Source: California Department of Water Resources 2012

Box 5-4 Central Valley WEAP Model

The California Water Plan supported the development of a model of the Central Valley by using the Water Evaluation and Planning (WEAP) system (see www.weap21.org). The WEAP system is a comprehensive, fully integrated river basin analysis tool. It is a simulation model that includes a robust and flexible representation of water demands from different sectors and the ability to program operating rules for infrastructure elements, such as reservoirs, canals, and hydropower projects (Purkey and Huber-Lee 2006; Purkey et al. 2007; Yates, Purkey et al. 2005; Yates, Sieber et al. 2005; Yates et al. 2008; and Yates et al. 2009). Additionally, it has watershed rainfall-runoff modeling capabilities that allow all portions of the water infrastructure and demand to be dynamically nested within the underlying hydrological processes. This functionality allows the analyses of how specific configurations of infrastructure, operating rules, and operational priorities will affect water uses as diverse as instream flows, irrigated agriculture, and municipal water supply under the umbrella of input weather data and physical watershed conditions. This integration of watershed hydrology with a water systems planning model makes WEAP ideally suited to study the potential impacts of climate change and other uncertainties internal to watersheds. The physical water management system represented in WEAP is represented conceptually below.



Box 5-5 Water Footprint as an Index of Sustainability

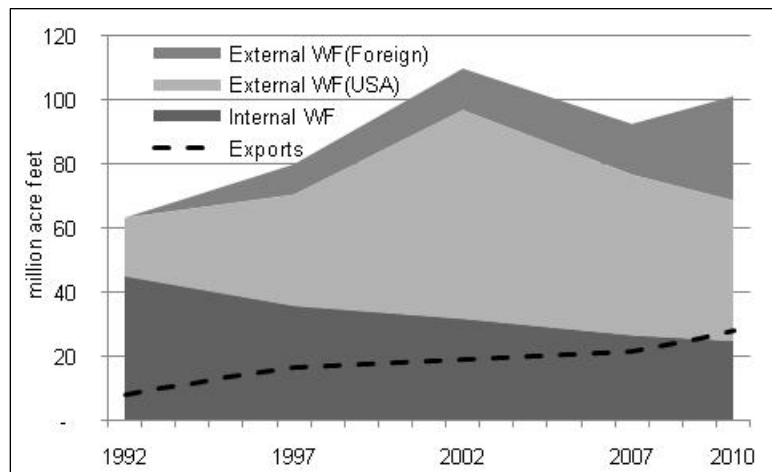
The California Water Plan includes California's Water Footprint as a broad index of demand for water resources by the people of California. The State's water footprint is a measure of the total volume of freshwater that is used to produce the goods and services consumed by Californians. This water use is measured in terms of the volume of water consumed (i.e., evaporated or incorporated into a product) in a given year. The water footprint has an internal and external component. The internal water footprint is the water required to make the goods that are produced and consumed within California, as well as the direct use of water inside the state. The external water footprint includes the water required to make goods in other places that are then imported and consumed in the state.

Monitoring how California's Water Footprint has changed over time can help planners understand how the state's water resources are being used, as well as how its population is being supported by both internal and external water resources. As shown in Figure A, California's Water Footprint has changed dramatically over the past two decades. During this period, the water footprint has increased by nearly 40 million acre feet (maf) per year, from about 60 maf in 1992 to 100 maf in 2010. During this period, California's internal water footprint has declined, while the external water footprint has grown dramatically, suggesting that the state has become increasingly reliant on external water resources. In addition, California's water resources have been increasingly devoted to products that are exported and consumed outside of the state.

Water footprint assessments address the complex ways in which humans interact with natural systems, such as the water cycle. Much of this complexity has to do with the global nature of California's economy, where goods and services are traded across regions, states, and among distant countries. So, for Californians, the goods and services we consume might be produced in many different places around the world. Thus, California affects and is affected by water resource conditions in other countries and other parts of the United States. A change in water availability elsewhere could affect not only California's economy, but also the way water is used here. The California Water Sustainability Indicators Framework definition of sustainability therefore implies a need to recognize water use not only within California but also in locations from where the products consumed in California are produced. The Water Footprint index helps address this complex task in a systematic way and may be used to address important issues related to sustainable water use in the state. For more information on California's Water Footprint, see the Volume 4 article and the 2012 report by the Pacific Institute, "California's Water Footprint," <http://www.pacinst.org/publication/assessment-of-californias-water-footprint/>.

PLACEHOLDER Figure A Changes in California's Water Footprint

Figure A Changes in California's Water Footprint



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Chapter 7. Finance Planning Framework

About This Chapter

California water managers have been directed to provide reliable water supplies, reduce flood risks, increase public safety, help grow the economy, and enhance ecosystems. These same demands have been placed on them with an adage of doing more with less during a time of economic downturn, rising public sector debt, and weakening public support for additional investments. This chapter initiates a process to address challenges in financing the programs and activities outlined in earlier chapters.

Chapter 7 establishes a framework in which multiple requirements, perspectives, and previously non-integrated financing information can be considered. Doing so enables stakeholders, collectively and in context, to consider the issues to be addressed and the decisions to be made. The content in this chapter informs and provides the rationale for the finance objective (Objective 17) and related actions (recommendations) in Chapter 8, “Roadmap For Action.” This chapter includes:

- Finance Planning Framework Scope and Process
 - Limitations of the Update 2013 Framework
- Key Facts and Findings
 - Demand for Funding
 - Expenditures and Fund Sources
 - Funding and Institutional Organization
- Framework Components
 - IWM Scope and Outcomes
 - IWM Activities
 - Existing Funding/Expenditures
 - Funding Reliability
 - State Government Role and Partnerships
 - Future Costs
 - Funding, Who and How
 - Trade-Offs
- Next Steps

Finance Planning Framework Scope and Process

This chapter reflects a first step in comprehensive integrated water management (IWM) finance planning from the State government’s perspective and goals. It serves to guide State government-funded investments in IWM. The investment scope includes IWM programs and projects directly administered by State government, as well as future State government IWM loans and grants distributed as incentives to regional and local governments. This chapter is not intended to direct regional or local finance decisions, and it does not intend to modify existing State investment frameworks for ongoing financial activities, such as distribution of currently authorized General Obligation (GO) bonds. This chapter, in conjunction with Chapter 8, “A Roadmap For Action,” provides a path for resolving issues described below and for filling information gaps as required to support effective State IWM finance solutions.

Several State agencies and stakeholders worked together to develop this Finance Planning Framework (Framework). The Framework provides a logical structure and sequence for financial plan development. This chapter is organized and presented in the same order as the eight components of the Framework. It

begins by describing the scope of IWM, as well as the types of IWM activities that should be considered for funding. It then offers background on how existing infrastructure was financed, along with descriptions of historical federal, State, and local water expenditures since 1985.

Along with Chapter 2, “Imperative to Invest in Innovation and Infrastructure,” this chapter reflects initial conversations with stakeholders regarding the role of State government in IWM. These conversations were conducted with regard to the costs associated with all State IWM activities. The Framework includes an estimate of the magnitude of California’s investment needs at federal, State, tribal, regional, and local levels. To help decision-makers determine how to meet these investment needs, the Framework provides an assessment of alternatives for future revenue sources. This assessment includes a description of appropriate uses of the revenue sources, any constraints and trade-offs involved in the application of the various sources, and current applications of the sources. (See Table 7-2.) The Framework recognizes the need to strategically invest in the near term to avoid greater costs in the long term (i.e., the concept of avoided costs).

Note that the terms finance and fund tend to be used interchangeably, and often refer to the other in their own definition. *Fund* refers to a supply or stock of money. *Funding* refers to making a supply of money available for a need, program, or project. *Finance* refers to the management of money, which could include such activities as borrowing or developing a revenue stream.

Limitations of the Update 2013 Framework

While the *California Water Plan Update 2013* (Update 2013) Framework provides a cornerstone for stakeholders to work collaboratively through critical funding needs and issues, develop durable finance mechanisms, and identify reliable revenue sources, it is not yet a comprehensive IWM finance plan. A comprehensive State government IWM investment strategy recommends programs and itemizes costs, finance mechanisms, and revenue sources. To that end, several remaining finance planning components must be completed that were not fully developed during Update 2013, owing to limitations of data/information, resources, and/or time. The “Next Steps” section of this chapter outlines actions to adapt, develop, and apply the Framework during California Water Plan Update 2018 and beyond. It also describes the activities, tasks, and deliverables that the Update 2013 staff and advisory groups want included in the Framework. It should be noted that even after developing an IWM finance plan, legislators and the governor must take action to implement such a plan.

Key Facts and Findings

Several striking facts and findings emerged in the development of the Framework. Most significantly, there is no single, easily compiled source of information about current and past IWM investments. This lack of integrated information creates several dilemmas. First, simply discussing finance expenditures often devolves into conflict. Second, stakeholders often operate from completely different sets of information prepared for disparate purposes. In most cases, the information is accurate but sometimes incomplete, drawn out of context, and grounded in fundamentally different assumptions. The reliance on information prepared for specific uses to make broader assumptions is problematic.

The Framework evolved as stakeholders worked together to create a common understanding of California’s water financing picture. Using a storyboard format, the goal was to establish a financing baseline and shared meaning about the past and current situation.

The facts and findings developed in this process represent a significant step forward in the comprehensive understanding of complex finance mechanisms that, over time, were created in a fragmented fashion. The sections that follow provide an overview of some of the findings and issues to be considered in implementing the Framework.

Demand for Funding

The status of California's water infrastructure, as well as the demands placed upon it, is of national interest. A number of different sources and estimates on demands for funding have been reported. Even with the variation in numbers among experts, the cumulative total is staggering, as demonstrated by the following examples.

An assessment, conducted by the U.S. Environmental Protection Agency in 2011 found that California will need \$44.5 billion to fix aging drinking water systems over the next two decades (U.S. Environmental Protection Agency 2013). The survey placed California at the top of a national list of states having major water infrastructure needs. In California and elsewhere, the biggest needs involve repairing and upgrading water transmission and distribution lines.

The American Society of Civil Engineers' (ASCE's) *Infrastructure Report Card for America*, is prepared every four years. Structured as a form of a school report card it assigns letter grades to each type of infrastructure. The 2012 report card gave California a "C" and assigned the following investment needs for water infrastructure (American Society of Civil Engineers 2012):

- Levees/Flood Control — \$2.8 billion per year.
- Urban Runoff — \$6.7 billion per year.
- Wastewater — \$4.5 billion per year.
- Water — \$4.6 billion per year.

Other key highlights from the ASCE evaluation indicate California has 807 high-hazard dams and only 45 percent of the State-regulated dams in California have an emergency action plan.

Information gathered in preparation of the report *California's Flood Future: Recommendations for Managing the State's Flood Risk* (California Department of Water Resources and U.S. Army Corps of Engineers 2013) provided significant facts and findings regarding flood risk and requirements for funding.

- \$575 billion in structures are at risk in the 500-year floodplains. This does not include economic impacts on families, communities, local businesses, and entire regions when worksites and public facilities are closed as a result of flood damage.
- More than \$50 billion in existing needs have been identified for flood management projects, which exceeds available funding sources.

The Bay Delta Conservation Plan (BDCP) is a 50-year ecosystem plan designed to restore fish and wildlife species in the Delta in a way that also protects California's water supplies while minimizing impacts on Delta communities and farms. The total estimated cost of implementing the BDCP, over the 50-year permit term, is approximately \$24 billion (California Department of Water Resources 2013).

Expenditures and Funding Sources

Cross-cut budgets for IWM activities are not compiled at most levels of government. This makes completion of a full assessment of actual investment and fund sources difficult. Beyond the wide variation in how different entities prepare budgets, the sheer number of entities involved in providing water-related services makes accurately compiling budget numbers a daunting task. At the local level, the funding complexities are especially difficult to navigate because activities often occur in proximity to one another, many projects serve multiple purposes, and many activities have multiple fund sources.

Local Expenditures

Local entities, such as special districts, water districts, utilities, and cities, account for the largest portion of IWM expenditures, and this is expected to continue for the foreseeable future. Annual local expenditures statewide for 2010 totaled about \$18 billion, as shown in Figure 7-3. Even with a significant investment by these agencies in water expenditures, the water management community reports that water projects at all levels of government are commonly underfunded.

The costs of ongoing operations and maintenance (O&M) for existing facilities, along with regulatory costs, consume a large portion of local agency budgets. In addition, local agency budgets are often unable to allocate funds for replacing aging infrastructure.

With limited funding sources and unreliable funding, financing and O&M are ongoing challenges for agencies. Some funding issues include:

- Competition among agencies for resources, such as workforce, grants, and technical assistance.
- Competition with other public demands for resources. For example, flood management agencies are often supported by local agency general funds and must compete with other public demands for such resources as transportation, parks, social services, education, and health services.
- Reductions in property tax revenues.
- Costs associated with permitting and mitigation of projects.
- Lack of resources in small agencies to prepare funding applications. For example, some of the information requested on grant or loan applications is not typically collected by the agency and not quickly developed. Also, smaller agencies might not have the resources to prepare an effective application.

Agencies also have difficulty raising matching funds for federal programs. Many of the agencies require federal or State funds for major capital improvements; however, with limited methods of local revenue generation, many agencies cannot access some of the available federal funds because they cannot raise the required matching funds.

Local agencies have indicated that they are often constrained in fully utilizing existing fund sources by various statutes and restrictions that govern financing considerations, per the following examples:

- Flood management agencies report they have substantial resistance to increasing property assessments, as evidenced by the passage of Propositions 13 and 218. The majority of flood management agencies depend on some type of property assessment as a revenue source; however, the ability to increase or initiate property assessments to satisfy revenue requirements has been restricted for some time in California.
- Agencies that are partially funded through development fees or special projects assessments can be limited by assessment-zone boundaries. These assessment-zone boundaries impose substantial

limitations on the uses of funds. This is important because flooding, water supplies, and water quality are sometimes affected by activities occurring upstream of zone boundaries. In addition, the solution or best management action for providing IWM benefits might be located outside the assessment-zone boundary.

State Funding

State government investments since the turn of the century have been directed to specific purposes (such as to the State Water Project) and used to successfully incentivize local investments in water-related projects.

State government expenditures and fund sources have shifted over time. In recent years, use of the General Fund (general tax base) has decreased and use of publicly financed bonds and special-fund sources have increased. Flexibility in utilizing fund sources is also limited at the State level. For example, several State GO bonds have been authorized since 2001, and State government revenues from special projects and fees have steadily increased from about \$1.3 billion in 2001 to \$2.7 billion in 2010. Nonetheless, funds for supporting specific IWM activities are not easily adapted to changing IWM priorities. Such funding sources are variable (i.e., annual funding levels) and unpredictable. Existing State bond funding for flood management will be depleted by 2018.

Federal Funding

The amount of funding flowing to the State from the federal government has also changed over time. These changes in fund sources reflect the perspectives and priorities of State and federal elected officials, as well as public perception and priorities for certain types of water-related expenditures. For example, federal investment has historically been the primary source of funding for flood management, but in the context of changing federal priorities such investment is decreasing relative to State government and local investments.

For most agencies, federal funds are becoming scarcer. The U.S. Army Corps of Engineers (USACE) process for identifying federal interest in flood risk-reduction projects has historically emphasized damage-reduction benefits, while placing less emphasis on other project output, such as ecosystem restoration, regional economic development, and other social benefits. With the fiscal issues facing the federal government, most agencies believe that federal funding programs will continue to be reduced, if not eliminated. As an example, the USACE might not continue to fund studies or ongoing projects at the same rate as in the past. Also, funding a large number of studies and projects over long periods is inefficient and results in delayed project development and increases project costs.

Operations, Maintenance, and Environmental Mitigation

While there is often funding for new projects, IWM planning and finance have not adequately covered monitoring, operations, maintenance, and environmental mitigation over the life of a project.

Environmental impacts created long ago, known as legacy impacts, no longer have responsible parties to pay for mitigation.

Debt

California voters, in response to drought and flood, have approved several State GO bonds to fund water projects. Because no additional tax or other revenue stream is created with the issuance of bonds over

time, GO bond debt service has taken an increasing share of California's State budget. California currently allocates about 9 percent of its general fund to total GO bond debt service. Out of the 10 most populous states, California ranks just behind New York for the highest debt-to-personal-income ratio (Office of the State Treasurer 2012).

Total authorized water-related bond debt rose from about \$3.8 billion in 1999 to \$22.9 billion in 2011, about 20 percent of total bond debt. By comparison, total authorized bond debt across all State government activities rose from \$38 billion in 1999 to \$128 billion in 2011. On a per capita basis, total GO bond debt rose from \$1,130 to over \$3,400. (See Table 7-4.)

While California is currently carrying a relatively high level of GO bond debt, debt is not the only metric to plan for or by which economic prosperity should be measured. Borrowing remains a necessary and cost-effective method of financing IWM and many other capital-intensive projects. However, there are risks and costs associated with borrowing that should be fully considered in future financing strategies.

Funding and Institutional Organization

Poor alignment of projects among public agencies affects the ability to fund and deliver efficient and economical multiple-benefit projects. In many cases, related IWM activities, such as water supply, flood, and ecosystem management projects, often in the same location or system, continue to be funded separately.

Overlapping — and sometimes conflicting — responsibilities and priorities among the many regulatory agencies complicate and/or increase the cost of protecting human life, property, economic interests, and the environment. While collaboration among the parties can yield significant benefits, in some cases the agencies are constrained by statutory mandates that prevent innovative solutions and expose the agencies to litigation.

Framework Components

The Framework is a first step toward more fully understanding California's financing picture and finding options to improve the current situation. During the Update 2013 process, a finance storyboard was developed through extensive collaboration with the Public Advisory Committee, Tribal Advisory Committee, Finance Caucus, and other Update 2013 participants. It was developed in response to observations and stakeholder input that there was no common language or understanding of the finance methods and issues across California's geographic regions, IWM strategies, or levels of government (e.g., federal, State, tribal, local). The finance storyboard was the thought process that developed into the Framework described in this chapter.

The purpose of the finance storyboard for Update 2013 and beyond is to provide a framework to organize and describe the suite of issues and methods critical for advancing a statewide IWM finance planning effort. It also provided the structure and the flow of logic required to synthesize a large volume of information and stakeholder input, such that it supports the IWM finance objective (Objective 17) and related actions for State policymakers. This storyboard also provided an approach for the diverse California Water Plan stakeholders and planning partners to discuss and develop a common language and understanding about the role of State government funding and investment in IWM activities.

The Framework is organized into eight components:

1. IWM Scope and Outcomes.
2. IWM Activities.
3. Existing Funding/Expenditures.
4. Funding Reliability.
5. State Government Role and Partnerships.
6. Future IWM Costs.
7. Funding, Who and How.
8. Trade-Off Analysis.

Each component represents a topic that stakeholders and planners felt needs to be part of any statewide IWM finance planning effort. The sequence of the components represents the necessary chronology of the planning effort. For example, it is necessary to define the scope of IWM (component 1) before discussing the State Government Role and Partnerships (component 5). It is also necessary to clarify the role of State government before estimating future funding demand for said role. Note that the traditional finance planning topic of apportioning costs and identifying funding methods does not occur until component 7.

The following sections describe each component of the Framework.

IWM Scope and Outcomes

The purpose of this section is to define the scope of State government's future involvement in IWM activities along with the expected outcomes. While the high-level synthesis of IWM benefits can be captured in the three broad categories of public safety, environmental stewardship, and economic stability, the further refinement of benefit descriptions below is more useful as a tool for determining if an activity is within the scope of IWM. The Finance Caucus approached this by describing the benefits intended to be achieved from the State's investment in IWM. If a proposed activity creates one or more of the benefits described in Table 7-1, it is within the scope of IWM.

PLACEHOLDER-Table 7-1 Benefits within the Scope of IWM

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of the chapter.]

IWM Activities

This section describes the types of IWM activities that need to occur to generate the benefits identified in the preceding section. This section defines the scope of activities encompassed in the finance objective and related actions detailed in Chapter 8, "Roadmap For Action." The activities described below represent opportunities to produce desired outcomes. This section describes investment categories to be used for guiding State government IWM investment (i.e., generally, categories of various types of projects or programs) in a way that is relevant to regional project-level activities. These investment categories were developed in response to several key findings that indicated a need to clarify and refine the methods for categorizing State IWM investments.

Categorization of future investments also helps formulate multi-objective, multi-benefit solutions comprised of combinations of the activities described below. Through intensive collaboration with the Update 2013 Finance Caucus, the categories presented below also helped build a common language and improving coordination among diverse bureaucracies. This approach will be useful for aligning funding

and finance planning processes across more than 2,300 federal, State, tribal, and local government entities, each with its own planning processes and scales. For example, local entities tend to plan at the project level while State policy-makers tend to plan at a broader level of investment category.

Two primary categories of investment are innovation and infrastructure, which are further broken down into investment sub-categories. These sub-categories could be used for allocating future State government investments.

Innovation includes actions that improve information, institutional, and technological activities essential for supporting IWM. Innovation categories include:

- **Governance improvements** to promote more coordinated and integrated resources planning among State government agencies and with regional collaboratives and federal agencies.
- **Planning/Public process improvements** to promote and incentivize communication, coordination, and collaboration among water planners/managers, land use planners/decision-makers, and other resource managers at the regional and watershed scale.
- **Strengthening government agency alignment** to improve coordination and consistency among federal, State, tribal, and local government agencies' data/information, plans, programs, policies, and regulations.
- **Information technology improvements** to promote and incentivize water data collection, management, distribution, access, and exchange/sharing, as well as analytical methods.
- **Water technology and science improvements** to advance science, improve and commercialize new water/energy technologies, improve data collection and exchange, and develop analytical tools for IWM.

Infrastructure includes structures and facilities that support human activities (grey infrastructure), as well as naturally occurring assets and services such as wetlands, riparian habitat, and watershed systems (green infrastructure). The categories listed below encompass not only the capital cost of constructing a facility or restoring habitat, but also the long-term operation and maintenance costs that have often been an afterthought to implementation and not adequately financed over their useful life (i.e., the accumulation of significant deferred maintenance and aging infrastructure). Infrastructure categories include:

- **Local and regional projects**, including projects contained in integrated regional water management (IRWM), capital improvement, urban water management, and many other local plans. These plans would include different mixes of the California Water Plan's 30 resource management strategies, depending on the region/location.
- **Inter-regional projects** that would benefit two or more regions.
- **Statewide systems** for water, flood, water quality, ecosystems, and wastewater management that provide statewide benefits.

Existing Funding/Expenditures

This section specifies the levels and sources of recent and current IWM expenditures. It includes a brief summary of historical federal, State, and local expenditures based on the defined scope of IWM. Much more detailed data, metadata, and information on this topic are included in Volume 4, *Reference Guide*.

Historical Overview

Historically, funding for water management in California has been provided by a combination of federal, State, and local agencies. Figure 7-1 shows the general historical spending and funding eras over the past

160 years, using broad categories. Starting with the Gold Rush, initial major infrastructure was put in place to bring land into production. Over the next several decades, multipurpose infrastructure projects were built. In the latter decades of the 1900s, investment shifted to include environmental protection projects. Shifts in financing eras are a result of major events, natural and human, and are generally reactive in nature. This past decade has seen several State bonds passed for infrastructure purposes, including flood management, as well as significant federal funding. More information on historical funding can be found in Chapter 3 and in Volume 4, *Reference Guide*.

PLACEHOLDER Figure 7-1 History of Funding for Water Management in California

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of the chapter.]

Local, State, and Federal Expenditures, 1995-2010

Figure 7-2 illustrates the average proportion of water management expenditures by local, State, and federal agencies between 1995 and 2010. Local agencies account for the largest portion of expenditures, averaging \$14.6 billion per year, followed by State agencies at \$1.9 billion and federal agencies at \$805 million per year. Expenditures vary over time, depending on factors such as State and federal appropriations and bond measures.

PLACEHOLDER Figure 7-2 Recent Annual Expenditures on Water Management in California, 1995-2010

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of the chapter.]

Figures 7-2 and 7-3 show that local agencies are responsible for the majority of the total expenditures. Between 1995 and 2010, annual project expenditures for water management in California ranged from approximately \$12.5 billion to \$21.7 billion, as shown in Figure 7-3. This figure shows total expenditures for IWM in California by local, State, and federal agencies. Local expenditures include water management activities by city, county, and special districts. State-level expenditures include water management activities in the Natural Resources Agency and California Environmental Protection Agency and general government. Federal expenditures include water management activities in California by federal agencies. Between 1995 and 2010, there were significant short-term bond infusions of funding for specific State projects. In Fiscal Year 2008-2009, federal expenditures had a one-time increase for shovel-ready projects owing to the passage of American Recovery and Reinvestment Act.

PLACEHOLDER Figure 7-3 Recent Trends in Local, State, and Federal IWM Expenditures (in millions), 1995–2010.

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of the chapter.]

Funding Reliability

This section provides a high-level description and qualitative summary of funding sources for IWM currently being used or that have been proposed in the past, and the role of State government bonds. More information on this topic can be found in Chapter 2, “Imperative to Invest in Innovation and Infrastructure.”

The future of water financing in California remains uncertain. Water management strategies are being integrated, but water management funding is still fragmented, thus limiting opportunities for further investment in water innovation and both green and grey infrastructure. Future financing mechanisms will need to capitalize on federal, State, tribal, regional, local, public, and private cost-sharing. Even with further integration, securing adequate funding will require innovative financing mechanisms, such as those used for other public infrastructure (e.g., transportation).

There is no single approach, mechanism, or revenue source for developing a reliable funding portfolio for IWM. Reliable funding will be driven by State, regional, and local interests, and solutions will need to be considered at a regional and/or local scale.

The financing mechanisms and revenue sources described below are presented in Update 2013 as an inventory of tools for advancing IWM activities and programs.

Funding Mechanisms and Revenue Sources

System capital improvements and ongoing O&M costs are typically financed with cash-on-hand or by issuing debt. Cash financing is often supported by user fees or taxes that support a general fund. User fees include volume-usage charges and service fees that typically are fixed, such as residential connection charges. Cash is typically used to pay for O&M costs, while larger capital project costs are primarily financed by issuing debt. Debt financing includes various types of bonds, ranging from GO bonds, which are backed by the General Fund, to builder revenue bonds, which are backed by special assessment districts. Access to different types of capital markets varies across State government and local agencies.

Federal finance strategies usually involve the federal treasury and finance water management projects selected based on benefit-cost analyses. Direct project beneficiaries reimburse the costs through user fees. For example, Central Valley Project (CVP) water supply contractors pay for water deliveries that finance CVP costs.

State government uses bonds to finance new water-management capital projects, including GO bonds and revenue bonds. GO bonds are backed by the taxing power of the State government and are paid off from the General Fund with interest. Financing for water infrastructure by State government has increasingly relied on GO bonds in recent years. GO bonds provide an infusion of capital to finance construction but may not adequately provide for O&M or ongoing repair costs. State government also uses lease-revenue bonds, which are similar to GO bonds but are not backed by the General Fund and do not require voter approval. Revenue bonds are not supported by the General Fund and are repaid by another revenue stream, typically user fees. (See Box 7-1 for a description of taxes versus fees.)

PLACEHOLDER Box 7-1 Taxes vs. Fees

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of the chapter.]



Local agencies primarily finance water management projects with revenue bonds. Revenue bonds carry a higher interest cost than GO bonds. Some projects are financed by local GO bonds backed by local property taxes, although this is less common because of the two-thirds voting requirements from Proposition 218. Local agencies additionally have access to state revolving fund (loan) programs and

state-funded local assistance grants. These typically involve cost-sharing between local and state government agencies.

Table 7-2 summarizes water management revenue sources that have been used or considered by State government and local agencies. Their appropriate uses, feasibility, key trade-offs, and applicability in California for these revenue sources are also described in Table 7-2.

PLACEHOLDER Table 7-2 State and Local Water Management Revenue Sources

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of the chapter.]

Federal Revenue Sources

Besides the annual contributions that federal government makes to the Clean Water and Drinking Water State Revolving Funds, several federal revenue sources could provide funding for California IWM. Depending on actions by Congress, funding may be available to the State or local governments. One of the most significant contributors of federal funds over the past few decades has been the Water Resources Development Act.

Water Resources Development Act

The Water Resources Development Act (WRDA) refers to a series of public laws enacted by Congress to deal with a range of water resources issues. The first WRDA, passed in 1974 (Public Law 93-251), amended the Flood Control Act of 1954 and authorized the USACE to undertake projects with additional purposes, such as navigation. There have been 10 WDRAs passed since 1974, with the latest passed in 2007. Over the years, it has been expanded to consider other purposes, such as ecosystem improvements, water resources development, and water conservation.

Congress is currently considering a 2013 WRDA introduced in May. As it is currently written, the legislation would establish a 5-year innovative project financing pilot program. This new pilot program would provide loans and loan guarantees for important flood management, water supply, and wastewater projects.

PLACEHOLDER Box 7-2 Federal Funding Sources

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of the chapter.]

California General Obligation Water Bonds

This section summarizes data for California water bonds issued between 1970 and present, and other GO bond debt, including schools and other infrastructure, to place the level of water bond debt into context. The intent of this section is to capture what is currently referred to as IWM, which includes water supply, water quality, ecosystem, and flood-management bonds. These water-related bonds have made up a larger portion of total bond debt in recent years. The trend shows an increase in GO bond financing of water projects as a portion of total GO bonds. Revenue bonds are also an important source of financing for capital projects, which are not supported by the General Fund and are generally used by local agencies, though they are not discussed in this section summary.

Table 7-3 summarizes water management-related bonds that were passed in California. In 2010 dollars, a total of \$32.4 billion in water bonds have been approved in California since 1970. Of this total, \$23.2 billion, or 71 percent, of the water bonds were passed since 2000. This shows the pronounced increased reliance on bonds for financing water infrastructure. On California's total GO bond debt of \$127.6 billion, the debt service is currently about 9 percent of the General Fund (see Table 7-4).

PLACEHOLDER Table 7-3 California General Obligation Water Bonds from 1970 to Present

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of the chapter.]

State GO bonds have become an important source of IWM funding. GO bonds are a fluctuating revenue source because of the intermittent nature of bond approval and sales, making them a somewhat unpredictable and unreliable revenue source for water projects. Table 7-4 shows total authorized state GO bonds as of 1999, 2005, and 2011. Total water bonds were \$3.8 billion in 1999, accounting for approximately 10 percent of total authorized State bonds; and increased to \$22.9 billion by 2011, or 18 percent of total authorized bonds, largely as a result of Propositions 1E and 84. Currently authorized water-related GO bonds are expected to be fully allocated by 2018.

PLACEHOLDER Table 7-4 Total Authorized GO Bond Debt in California (in billions)

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of the chapter.]

Figure 7-4 shows that funding for IWM projects has gradually increased as a portion of total bond funding — 10 percent of the total in 1999 to 18 percent by 2011.

PLACEHOLDER Figure 7-4 Total Authorized State General Obligation Bonds in California

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of the chapter.]

Figure 7-5 illustrates outstanding GO bond funding for water-related activities over time. Authorized GO bonds and federal funding accounted for approximately two-thirds of total water management expenditures in FY 2012. In recent years, State bond funds have become a larger portion of total water-related investments in California, as federal expenditures have stayed the same or decreased. Annual debt service for outstanding water bonds is approaching \$80 per household because water bonds make up a larger proportion of water funding. By comparison, when distributed equally among all households in the state, the total annual debt service amounts to \$365 per household (see Volume 4, *Reference Guide*, the article “[under development]”).

PLACEHOLDER Figure 7-5 General Obligation Water Bond History, 1970-2012

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of the chapter.]

State Government Role and Partnerships

This section summarizes the current and future role of State government to support and advance IWM regionally and statewide. It includes a description of current and future State government obligations and commitments, as well as of its role in investing in IWM innovation and infrastructure. A more detailed

description of State government’s role can be found in Chapter 2, “Imperative to Invest in Innovation and Infrastructure.”


In the history of water development in California, the role of federal and State governments has been demonstrated by their investments in water and flood management infrastructure to promote growth and economic development in rural, suburban, and urban communities. These investments resulted in major projects that crossed watersheds and/or had broad-based public benefits. During the past few decades, government’s role has also included environmental protection and enhancement. More recently, State government is promoting multi-benefit IWM programs and projects with more sustainable outcomes, and ensuring that disadvantaged communities have safe water and sanitation. (Refer to the “Shared Values for State Government Investment and Prioritization” section of this chapter.)

Basic Obligations

The obligations of State government include:

- **Representing California in government-to-government interactions** with the federal government, other states, and other sovereign nations and tribal governments.
- **Meeting basic public health and safety needs for all Californians** by regulating minimum public health standards and by providing assistance to communities that are unable to meet regulations.
- **Protecting public trust resources** by regulation and in planning and allocation of water resources. The public trust doctrine recognizes that certain natural resources, including water, tide and submerged lands, the beds and banks of navigable rivers, and fish and wildlife resources are owned by the public and held in trust for present and future generations of Californians.
- **Protecting unique real property interests.** The State has a fundamental responsibility to California taxpayers to protect the real property assets owned by the State and reduce State liabilities.

Commitments and Responsibilities

- **Operate and manage the State Water Project.** State government is the owner and operator of the State Water Project (SWP) and has the responsibility (and contractual commitments) to provide reliable water supplies to the water contractors, the financiers and beneficiaries of the SWP.
- **Plan, implement, and maintain the State Plan of Flood Control.** State government has responsibility for providing assurances to construction access, operations, and maintenance for portions of the State’s federally authorized flood protection system.
- **Planning, policy research and technical assistance.** State government performs many critical planning and research activities in support of resource management (executive, legislative, and local government) decisions and advancing water science and technology. 
- **Integrate water rights and water quality planning.** Basin plans are prepared for each of the 10 hydrologic regions and by statute become part of the California Water Plan.

Investing in Innovation and Infrastructure

State government has and should take a leading role in investing in innovation and infrastructure actions for the benefit of all regions. Innovation includes a broad range of activities that comprises governance, planning, and process improvements; data; tools; and water technology research and development. State government can also demonstrate leadership by serving as a facilitator and clearinghouse of innovation to

ensure that new solutions are fully utilized throughout the state. The State’s investment in innovation provides processes and information that aid decision-making throughout the state and support more cost-effective infrastructure investments by regional and local entities.

State government has and should continue to invest in water infrastructure — natural (green) and built (grey) — in partnership with federal, tribal, regional, and local governments; non-profit organizations; the business community; and private entities.

State government investments should focus on actions that:

- Regions and communities cannot accomplish on their own.
- Involve interregional, interstate, or international issues.
- State government can do more efficiently and/or cost-effectively (i.e., providing a high return on investment to the benefit of the state’s taxpayers).
- Provide broad public benefits.
- Remediate legacy environmental impacts.

Future IWM Costs

This section summarizes anticipated total future IWM costs throughout California and across federal, State, tribal, and local governments. Owing to many data gaps and lack of a consistent methodology, Update 2013 includes a preliminary and cursory estimate of future IWM costs. Additional engineering, economic, and risk characterization studies are needed to develop more accurate projections of California’s future IWM funding needs (see the “Next Steps” section, below). That said, based on recent and existing IWM expenditures and a reasonable assumption of needed near-term innovation and infrastructure, it is estimated that at least \$200 billion is needed over the next decade. This estimate assumes that future average annual IWM expenditures over the next 10 years would occur at approximately the same rate as current annual expenditures (\$20 billion per year as shown in Figure 7-3). Because authorized GO bonds are almost fully allocated, and federal and State general fund IWM allocations are declining, new finance mechanisms and revenue sources will be needed to sustain current annual expenditure levels. The majority of all IWM investments in California during the next decade will go toward meeting infrastructure needs. A smaller but important portion will go toward innovation to increase return on IWM investments.

The estimate of \$200 billion needed for innovation and infrastructure over the next decade encompasses federal, State, and local investments. Local entities will pay the majority of these costs. State government investment in innovation will be only a small portion of this estimate, perhaps less than a few hundred million dollars. State government investment in infrastructure, including financial incentives and cost-sharing with federal, local, and private partners, will depend on future authorizations, funding mechanisms, and revenue sources (as described in the “Funding Mechanisms and Revenue Sources” section, above).

The California Flood Future Report identified more than \$50 billion in needs for specific projects and improvements that are now in the planning cycle. These projects (mostly site specific) collectively would not provide statewide protection from the 100-year storm event. The total investment needed to reduce risk against the 500-year flood event is assumed to be several times the \$50 billion amount. This is based on the 5.8-million increase in population exposed within the 500-year floodplains, compared with 1.4 million in the 100-year floodplain. Despite this risk, willingness to fund flood management for a 500-year storm event has not been demonstrated. For this reason, a conservative estimate for flood

management investments, based on what Californians would be willing to accept and pay for, could be at least twice the \$50-billion estimate for existing proposed projects, or more than \$100 billion.

As previously mentioned, ASCE’s 2012 *Infrastructure Report Card for America* gave California a “C” and assigned the following investment needs for water infrastructure:

- Levees/Flood Control — \$2.8 billion per year.
- Urban Runoff — \$6.7 billion per year.
- Wastewater — \$4.5 billion per year.
- Water — \$4.6 billion per year.

An assessment, conducted by the U.S. Environmental Protection Agency in 2011 found California could use \$44.5 billion to fix aging drinking-water systems over the next two decades (U.S. Environmental Protection Agency 2013). The survey placed California at the top of a national list of water infrastructure needs. In California and elsewhere, the biggest need was for repairing and upgrading water transmission and distribution lines.

The BDCP is a 50-year ecosystem plan designed to restore fish and wildlife species in the Delta in a way that also protects California’s water supplies while minimizing impacts on Delta communities and farms. The total estimated cost of implementing the BDCP, over the 50-year permit term, is approximately \$24 billion (California Department of Water Resources 2013).

As another estimate of future IWM costs, there are approximately 10,000 water projects identified by the state’s 48 IRWM regional water management groups. Although it is unlikely that every project would be implemented, the total cost of these projects would be several hundred billion dollars.

Funding, Who and How

This section frames the discussion for future IWM financing mechanisms and revenue sources. It describes shared values for guiding State government investments and prioritization, how to allocate State government funding, and desired attributes of future financing mechanisms and revenue sources. More information can be found in Chapter 2, “Imperative to Invest in Innovation and Infrastructure,” and in Volume 4, *Reference Guide*.

Shared Values for State Government Investment and Prioritization

An essential first step completed during Update 2013 was identifying shared values to guide decisions related to the Framework. The shared values described below are intended to guide IWM decisions regarding investment and prioritization of State government funds. The scope includes IWM programs and projects directly administered by State government, as well as future State IWM loans and grants that are allocated as incentives to tribal, regional, and local governments. These values can also guide preparation of future criteria for State government funding. These values are not intended to direct tribal, regional, or local finance decisions, and they are not intended to modify existing State investments or ongoing financial activities, such as the allocation of currently authorized GO bonds. The shared values are also not intended to provide guidance for financing of specific projects at any scale (statewide, inter-regional, regional, tribal, or local).

The shared values developed for Update 2013 are grouped into three categories: Prioritization of State Government Investments, Fiduciary Responsibility, and Beneficiary and Stressor Responsibility.

Prioritization of State Government Investments — Investment decisions will include equal regard for economic, environmental, and social criteria.

- Decisions are informed and priorities are set using a process that includes broad stakeholder interests and public participation.
- Preference is given to multi-benefit projects that meet regional or statewide interests.
- Cost and benefit data used in the analysis include monetary and nonmonetary life-cycle costs and benefits with an emphasis on long-term planning. Stranded costs are avoided, and all costs during the life of a project are included in the analysis, such as monitoring, planning, construction, operation, maintenance, mitigation, business disruptions, and externalities.
- Decisions are made using best available data and knowledge, understanding that deferring decisions in anticipation of better information can increase cost of implementation, create hesitation, and miss opportunities to achieve benefits.

Fiduciary Responsibility — State government will be fiscally responsible with State funding.

- Investment decisions account for the availability of future revenues, cost of borrowing, and risks of indebtedness. This includes matching investments with appropriate funding mechanisms and revenue sources.
- Good stewardship of State government funds includes transparency, accountability, discipline to spend reasonably, clarity of purpose, and personal integrity by those entrusted with public funding. Good stewardship engenders trust and increases the public's willingness to pay for future IWM activities.
- State government funding is not redirected from its authorized purpose.
- Amount of time needed to repay debt does not exceed the life of a project. This value applies to fiscal, natural, and all other emergencies.

Beneficiary and Stressor Responsibilities — Those receiving benefits or creating impacts pay for them.

- When beneficiaries can be identified, those receiving benefits pay for them. A nexus and proportionality is established between charges and benefits. This value recognizes the concept of equity regarding value exchange (i.e., paying in proportion to what you receive).
- State government has a responsibility to help communities that cannot help themselves. State funding is also appropriate for helping communities meet State regulations that they cannot fully cover.
- State funding pays for broad statewide benefits.
- State government pays for persistent impacts from historical activities that are no longer creating impacts of the same type or magnitude (legacy impacts), but only in cases where stressors cannot be identified or no longer exist. In some cases, legacy impacts may go unaddressed indefinitely.
- State funding is proportional to the broad public interest. Assignment of costs to entities that currently engage in an activity that involves an area affected by legacy impacts is limited to the entities' current impacts (not legacy impacts). Some legacy impacts may need to be addressed before costs are assigned.

Attributes to Frame Future Deliberations

Update 2013 discusses better organizational alignment of State agencies as a way to expedite implementation of IWM activities and reduce the cost of delivering IWM benefits. (See Chapter 4,

“Strengthening Government Alignment,” for more details.) One way to improve State government IWM finance is through a more coordinated and consistent funding approach across State government. Such an approach could also provide an opportunity to implement several components of the Framework and advance the shared values for State government investment and prioritization. A coordinated funding approach needs to be designed to increase return on investment, enhance accountability, and improve consistency and efficiency. Other goals for new approaches include allocating State dollars to leverage federal and private funding, increase local flexibility to reflect local and regional conditions, and to advance regional goals and investment priorities with grants and loans. Future deliberations should include, but are not limited to, the following attributes:

- Funding mechanisms that provide a consistent financing framework for State government investments in IWM and achieve the following:
 - Improve cost effectiveness, efficiencies, and accountability.
 - Avoid stranded costs and funding discontinuity.
 - Leverage funding across State government agencies.
 - Increase certainty of desired outcomes.
- Prioritization based on shared funding values, defined principles, goals, objectives, and criteria.
- Prioritization method and rationale for apportioning IWM investment by the categories and subcategories developed in the Update 2013 Framework (i.e., innovation and infrastructure).
- Methods for enhancing stewardship of State government monies at both statewide and regional scales, including strategies to improve the transparency and accountability of State fund disbursements.

Trade-Off Analysis

This section outlines a proposal to develop a decision support system to examine funding scenarios and help analyze trade-offs. More information can be found in Chapter 6 and Volume 4, *Reference Guide*.

California faces tough decisions and trade-offs to allocate increasingly scarce funds to support IWM. Water management must compete for financial resources with a myriad of other infrastructure demands. When investment needs exceed existing available funding levels, it becomes increasingly important for decision-makers to prioritize new water projects while accounting for the trade-offs.


IWM decisions typically involve some type of collaborative process. The decision process can be characterized by two fundamental components, decision support and decision-making. Decision support involves consideration of the entire system and how (or if) a potential project fits within existing infrastructure and policies. Decision-making requires additional information, such as selection criteria, availability of funds, and project costs and benefits. The decision-making process typically results in some type of ranking of alternatives, whereas the decision support process evaluates how a project fits within a system.

A consistent and understandable framework for displaying important costs, benefits, and other impacts of potential projects can help inform these decisions. A Decision Support System (DSS) is a general term for a computer-based approach to provide structured and consistent information for decision-making. When options are numerous, interrelated, and have complex effects, decision-makers need to be able to screen the options, eliminate those that clearly do not meet the project goals and criteria, and identify a smaller number of scenarios that warrant further consideration and analysis. Both the screening step and the detailed analysis step can be greatly assisted by a DSS.

Next Steps

This section proposes actions to adapt, develop, and apply the Framework during Update 2018 and beyond. It describes many activities, tasks, and deliverables that the Update 2013 staff and advisory groups want included in the Framework but were not completed during the Update 2013 process. In addition to the actions below to improve the Framework, Chapter 8, “Roadmap For Action,” contains a finance objective together with several related actions to improve the financing of IWM activities in California.

While the Framework is intended to guide decisions on state government funding, there is value in considering the Framework as a tool for identifying and sequencing all relevant finance planning activities at any level of government. Future water plan updates will continue to advance and refine the Framework. Future work is expected to consider each component (as developed by the Finance Caucus for the Finance Storyboard) of the Framework in the following ways:

- **IWM Scope and Outcomes (Component 1)** — Revisit, clarify, and adapt the scope of IWM to changing conditions and priorities.
- **IWM Activities (Component 2)** — Develop more specificity regarding the types of activities that State government should invest in with a clearer nexus to the types of anticipated benefits.
- **Existing Funding (Component 3)** — Continue to compile and synthesize data that tracks historical water-related expenditures across local, State, and federal governments in California.
- **Funding Reliability (Component 4)** — Work with the State Agency Steering Committee to identify where potential funding gaps exist between the State IWM activities described in component 2 and existing funding levels and sources. Collaborate with regional water management groups to do the same for local and regional IWM activities. 
- **State Role and Partnerships (Component 5)** — Continue to clarify and elaborate on the future role of State government to support a more specific description and estimate of future costs.
- **Future Costs (Component 6)** — Estimate future funding demands by (a) launching IRWM, city, county, and special-district data pull, and (b) working with the State Agency Steering Committee to estimate the funding demand for existing and future IWM activities.
- **Funding, Who and How (Component 7)** — Continue to collaborate with stakeholders and federal, State, tribal, and local governments to investigate and develop finance mechanisms and revenue sources that address the facts and findings detailed in this chapter. Future deliberations should include, but are not limited to, the following attributes:
 - Funding mechanisms that provide a consistent financing framework for State government investments in IWM and achieve the following:
 - Improve cost effectiveness, efficiencies, and accountability.
 - Avoid stranded costs and funding discontinuity.
 - Leverage funding across State government agencies.
 - Increase certainty of desired outcomes.
 - Prioritization based on shared funding values, defined principles, goals, objectives, and criteria.
 - Prioritization method and rationale for apportioning IWM investment by the categories and subcategories developed in the Update 2013 Framework (i.e., innovation and infrastructure).
 - Methods for enhancing stewardship of State government monies at both statewide and regional scales, including strategies to improve the transparency and accountability of State fund disbursements.

- **Trade-Off Analysis (Component 8)** — State government should develop a DSS to provide guidance and leadership for defining uncertainties of future cost, benefits, prioritization, and other trade-offs. The DSS would inform prioritization of State government expenditures, estimation of expected IWM benefits, and methods for apportioning costs across financiers. It also includes developing a clear and consistent methodology for identifying public benefits associated with the entire range of IWM activities.

References

References Cited

- American Society of Civil Engineers. 2012. *California's Infrastructure Needs \$65 Billion in Major Improvements: State's Infrastructure Earns an Overall Grade of "C" from Local Civil Engineers*. Region 9 news release. February 29, 2012. Viewed online at: http://www.ascecareportcard.org/data_specific/CA_Report_Card_News_Release.pdf. Accessed:
- California Department of Water Resources. 2013. *Estimated Cost to Implement the BDCP*. Viewed online at: http://baydeltaconservationplan.com/Libraries/Dynamic_Document_Library/Estimated_Cost_to_Implement_the_BDCP_Brochure_5-29-13.sflb.ashx. Accessed:
- California Department of Water Resources and U.S. Army Corps of Engineers. 2013. *California's Flood Future: Recommendations for Managing the State's Flood Risk*. Public Draft. Viewed online at: http://www.water.ca.gov/sfmp/resources/PRD_FFR_4-3-13MainRPT_5-13-13.pdf. Accessed:
- Office of the State Treasurer. 2012. *State of California Debt Affordability Report*. Viewed online at: <http://www.treasurer.ca.gov/publications/2012dar.pdf>. Accessed:
- U.S. Environmental Protection Agency. 2013. *Drinking Water Infrastructure Needs Survey and Assessment*. Fifth report to Congress. EPA 816-R-13-006. Viewed online at: http://water.epa.gov/grants_funding/dwsrf/upload/epa816r13006.pdf. Accessed:

Table 7-1 Benefits within the Scope of IWM


IWM Benefit Type	Definition
Affordability	Occurrence of water supplies of sufficient quality, certainty and cost to enhance or serve disadvantaged communities, sustain diverse portfolios existing and future of economic activities as well as achieve water costs that enable, at a minimum, current levels of standard of living.
Drought Damage Reduction	The magnitude and probability of economic, social or environmental consequences that would occur as a result of a sustained drought.
Energy	Efficient use, or increases in production/recovery of, energy associated with managed and unmanaged water use, storage, treatment, distribution and/or reuse. 
Environmental	Preservation or restoration of the fish, wildlife, natural processes/functions, habitat and other aquatic resources for the continued viability of natural heritage, self-sustaining ecosystems and/or biodiversity. (e.g. recovery of sensitive species, control of invasive species, adequate water supply and quality)
Flood Damage Reduction	Reduce the adverse impacts of floods to human and natural systems through a portfolio of structural and non-structural measures that address their vulnerability, exposure and recovery during flood events. This includes pre-flood planning and hazard mitigation, emergency preparedness and response activities, and post-event repairs (including environmental infrastructure repairs).
Food Security	Adequate reliability, affordability, and supply of water, land and other natural resources to reliability to support domestic production of food, fiber, livestock, and other farm products to meet current and forecasted consumer demands.
Fuel Load Management	Fuel reduction involving the modification of vegetation in order to reduce potential fire threat, reduce the risk of high severity wildfires thereby; (1) preserving water quality and natural water treatment processes within watersheds; (2) avoidance of downstream sedimentation impacts on water supply; and/or (3) improve wildlife habitat capability, timber growth, or forage production.
Groundwater Overdraft Reduction	Avoidance of the condition of a groundwater basin in which the amount of water withdrawn by pumping exceeds the amount of water that recharges the basin over a period of years during which water supply conditions approximate average conditions.
Operational Flexibility and Efficiency	Optimization of existing legal, operational and management procedures for (and/or physical modifications to) existing water management faculties to improve the efficiency of existing water operations or uses (e.g., irrigation)
Reduce Climate Change Impacts	Development and implementation of strategies that improve resiliency, reduce risk, and increase sustainability for water and flood management systems and the ecosystems upon which they depend.
Water Dependent Recreational Opportunity	Opportunities for water-dependent recreation for California's residents, communities and visitors now and into the future (e.g. skiing, fishing, kayaking, etc)
Water Quality	Chemical, physical, and biological characteristics of water, usually in regard to its suitability for a particular purpose or beneficial use for the enhancement or preservation of public and environmental health
Water Supply and Supply Reliability	Occurrence of water supplies of sufficient quality and certainty to enhance or sustain and grow current types and levels economic activities, ecosystem health and maintain quality of life

Table 7-2 State and Local Water Management Revenue Sources

Revenue Source	Appropriate Uses	Feasibility	Key Tradeoffs	Application in California
General Fund	Activities that benefit the general public	Available each year, but subject to competing uses	Funds are limited	A common source of funding
General Obligation Bonds	Projects that benefit the general public	Commonly used	Subject to a vote	Commonly used, but some concern about getting future bonds approved
Revenue Bonds	Projects where a dependable revenue stream is available	A standard method of financing	None	A typical method of financing for local and state projects
User Fees	Projects where direct beneficiaries are easily identified.	Potentially works well with clearly defined beneficiaries, less likely to work for projects with significant public benefits.	Will focus projects to those with local scope which may undermine IWM efforts. May limit state's ability to increase fees and taxes to support other projects.	State Water Project is an excellent example as over 90% of project cost will be repaid by direct beneficiaries (contractors)
Assessment Districts	Can be formed by majority vote but must support local projects that do not provide a "general" public benefit. Water and storm water projects are generally allowed under assessment districts.	The state could coordinate with local agencies to establish assessment districts.	Assessment districts cannot be used to support general public benefits and, as such, will tend to focus on local projects.	1911 and 1913/1915 assessment districts are widely used by local agencies in California.
Utility User Tax	Earmarked for a special purpose or used as a general tax	Used by many cities and a few counties	Has to be approved by a ballot measure.	Widely used by cities
Impact Fees	Used by local governments to charge new development for the additional cost imposed on existing public infrastructure.	Impact fees are generally used in over 90% of local governments in California, thus there is limited opportunities for further expansion.	Deters new development.	Widely used in California
Statewide Water Use Fee (Proposed in 2006 and 2011)	Would have been used for state water management activities	Failed to move forward in 2006 and 2011	Could impact local agencies ability to generate local revenues	Would require a vote

Revenue Source	Appropriate Uses	Feasibility	Key Tradeoffs	Application in California
Public Goods Charge	Could fund a variety of IWM activities	Was approved for electricity but sunset in 2011. Never has been tried with water.	Could impact local agencies ability to generate local revenues	Not yet tried in California, would need a two-thirds vote
Mello-Roos Special Taxes	Areas with new development. It is possible to establish Community Facility Districts (CFDs) in other areas, but this requires a majority vote by residents to tax themselves.	CFDs are most feasible during strong housing markets when there is significant new development.	When housing markets and development slows, forming additional CFDs is difficult and there may be concerns with revenues to pay back existing bonds.	Recently used to finance the Bear River Levee Setback project in Yuba County
Private Investors	Local water projects that generate revenue	Typically have been used as part of design-build process	Interest rates are higher than public debt, can't be used on state projects	Limited to local projects
Private-Philanthropic	Traditionally has been used for ecosystem projects	Commonly used	Not a predictable revenue source	Widely used in California

Table 7-3 California General Obligation Water Bonds from 1970 to Present

Year	Title	Base Amount (millions)	In 2010 Dollars (millions)
1970	Clean Water Bond Law of 1970 (Prop. 1)	250	1,504
1974	Clean Water Bond Law of 1974 (Prop. 2)	250	1,028
1976	California Safe Drinking Water Bond Law of 1976 (Prop. 3)	175	606
1978	Clean Water and Water Conservation Bond Law of 1978 (Prop. 2)	375	1,123
1982	Lake Tahoe Acquisitions Bond Act (Prop. 4)	85	185
1984	California Safe Drinking Water Bond Law of 1984 (Prop. 25)	75	150
1984	Clean Water Bond Law of 1984 (Prop. 28)	325	651
1984	Fish and Wildlife Habitat Enhancement Act of 1984 (Prop. 19)	85	170
1986	Water Conservation and Water Quality Bond Law of 1986 (Prop. 44)	150	290
1986	California Safe Drinking Water Bond Law of 1986 (Prop. 55)	100	193
1988	California Safe Drinking Water Bond Law of 1988 (Prop. 81)	75	138
1988	California Wildlife, Coastal, and Park Land Conservation Act (Prop. 70)	776	1,427
1988	Water Conservation Bond Law of 1988 (Prop. 82)	60	110
1988	Clean Water and Water Reclamation Bond Law of 1988 (Prop. 83)	65	120
1996	Safe, Clean, Reliable Water Supply Act (Prop. 204)	995	1,471
2000	Safe Drinking Water, Clean Water, Watershed Protection, and Flood Protection Act (Prop. 13)	1,970	2,632
2000	Safe Neighborhood Parks, Clean Water, Clean Air, and Coastal Protection Bond Act of 2000 (Prop. 12)	2,100	2,805
2002	California Clean Water, Clean Air, Safe Neighborhood Parks, and Coastal Protection Act of 2002 (Prop. 40)	2,600	3,305
2002	Water Security, Clean Drinking Water, Coastal and Beach Protection Act of 2002 (Prop. 50)	3,440	4,372
2006	Disaster Preparedness and Flood Protection Bond Act of 2006 (Prop. 1E)	4,090	4,385
2006	Safe Drinking Water, Water Quality and Supply, Flood Control, River and Coastal Protection Bond Act of 2006 (Prop. 84)	5,388	5,777

Table 7-4 Total Authorized General Obligation Bond Debt in California (in billions)

Category	1999	2005	2011
Miscellaneous	1.7	2.5	3.3
Correctional	4.1	4.1	2.8
Total Water Bonds	3.8	14.0	22.9
Transportation	5.6	7.2	40.0
Education	22.4	51.1	58.6
Total	37.7	78.9	127.6
Per Capita	1,127.2	2,191.9	3,407.9

Source: State of California 2010

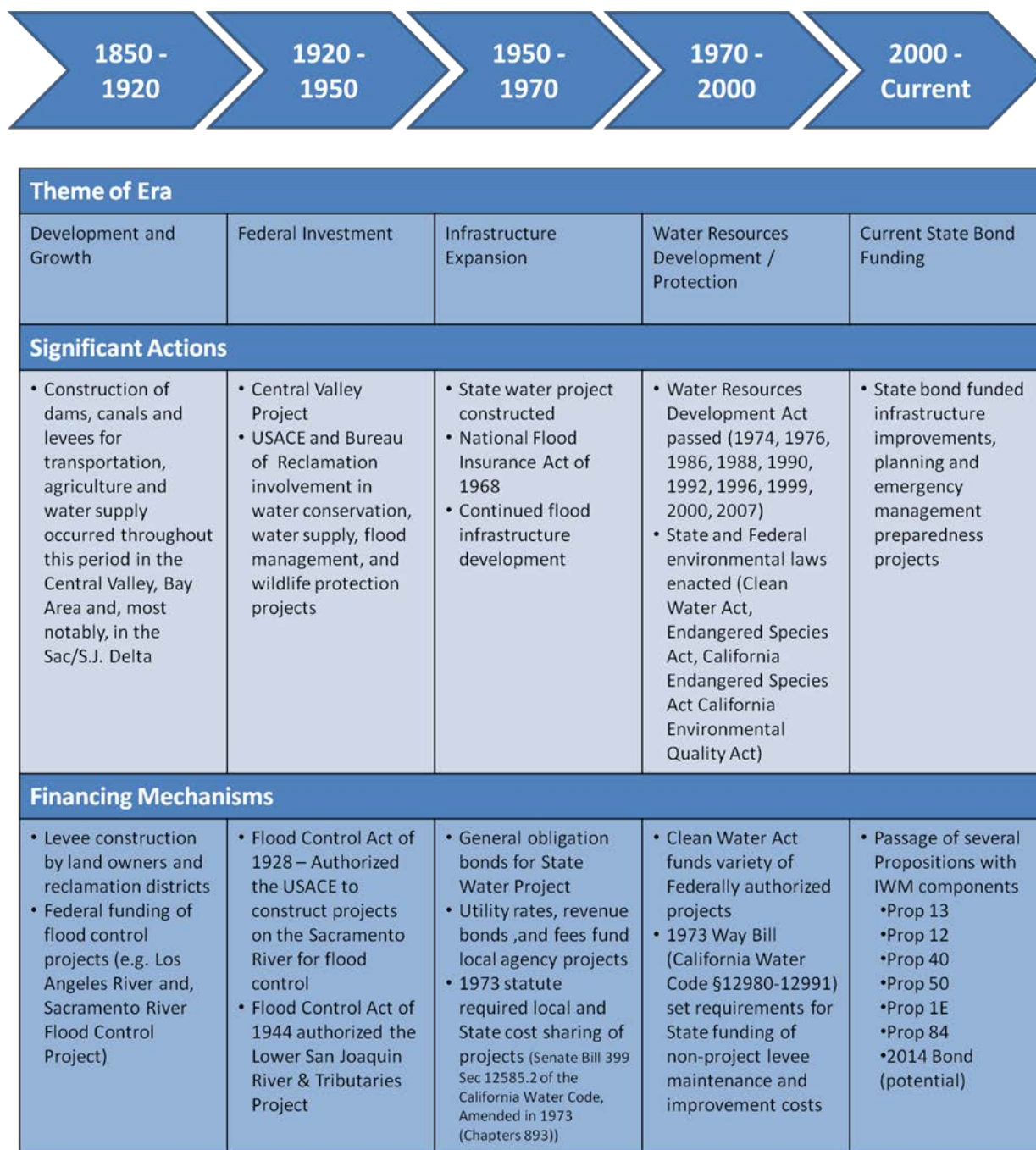
Figure 7-1 History of Funding for Water Management in California

Figure 7-2 Recent Annual Expenditures on Water Management in California, 1995-2010

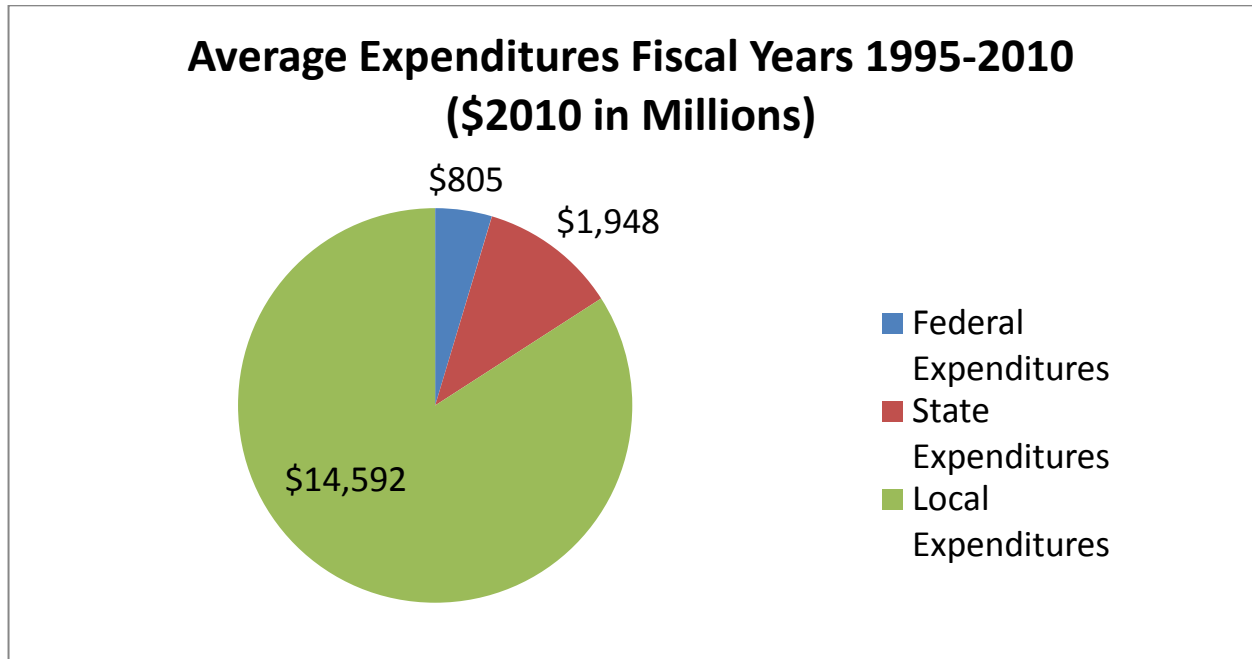


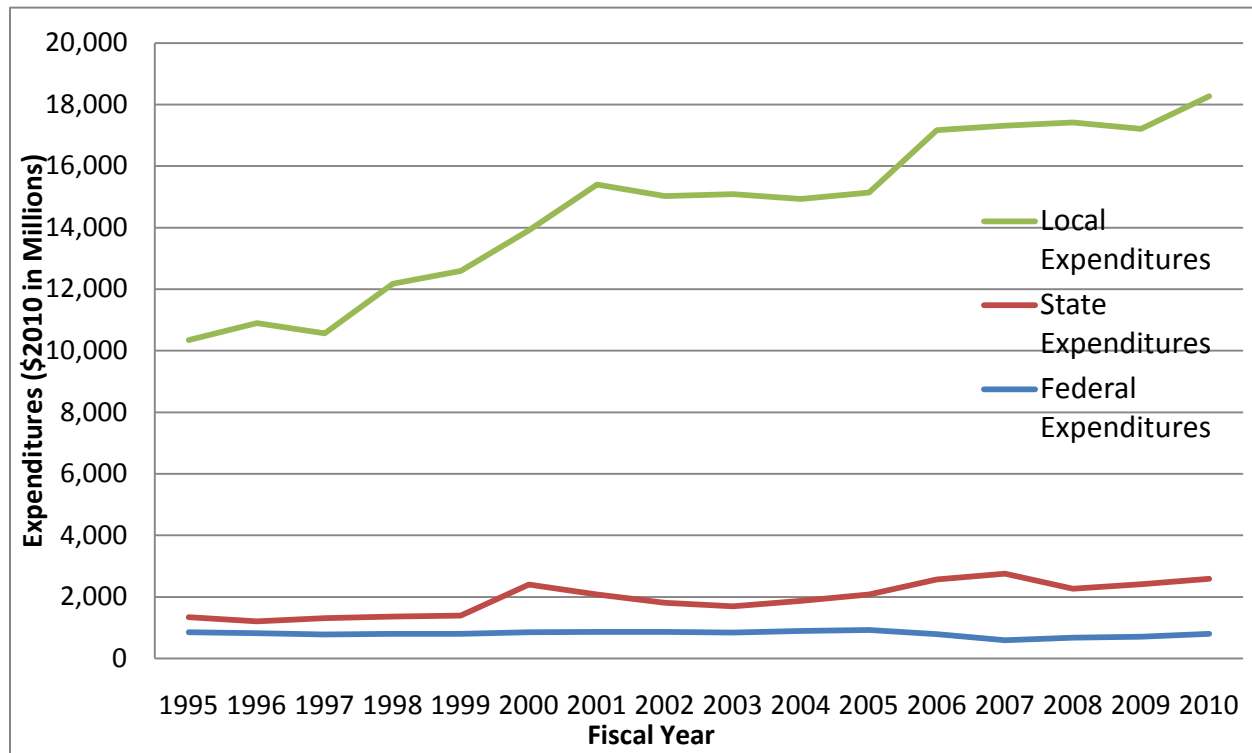
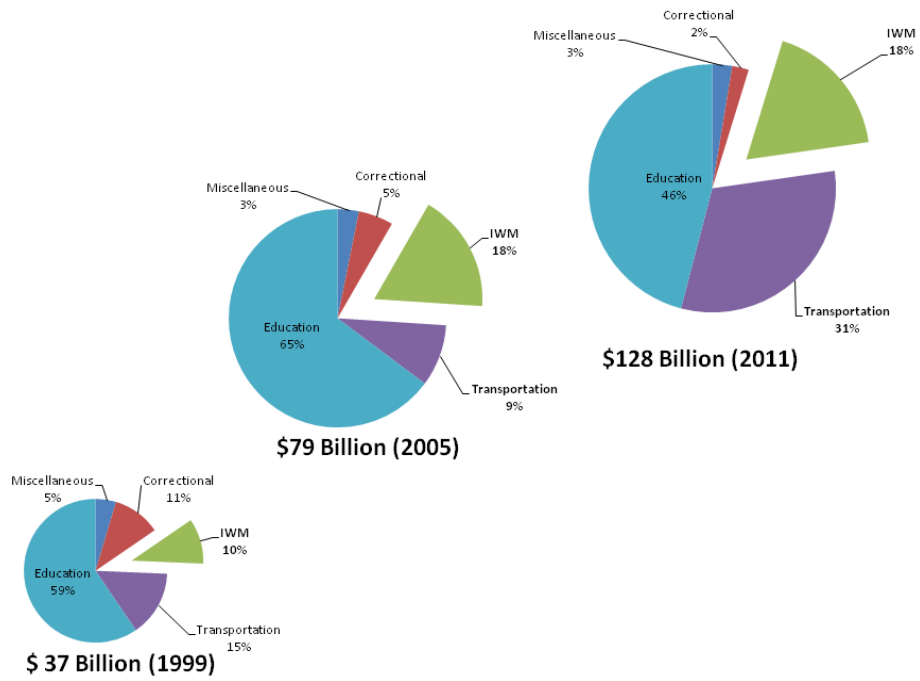
Figure 7-3 Recent Trends in Local, State, and Federal IWM Expenditures (in millions) 1995-2010

Figure 7-4 Total Authorized State General Obligation Bonds in California



Source: State of California 2010

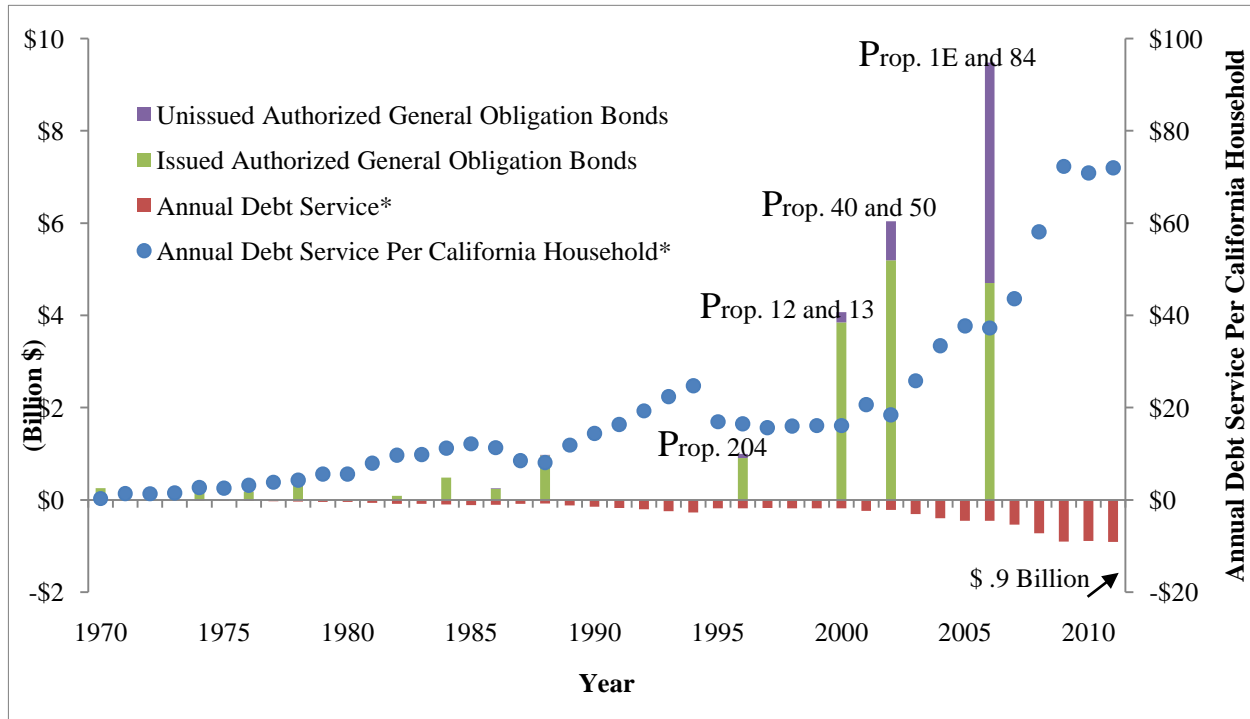
Figure 7-5 General Obligation Water Bond History, 1970-2010

Figure note: Debt service is applicable to issued GO bonds only.
Source: Department of Finance 2012

Box 7-1 Taxes vs. Fees

Taxes are paid by the general public for governmental services that provide benefits to the general public, such as public safety. The payment is mandatory, everyone pays, and there does not need to be a nexus between the payer and service provided. The payer, as well as everyone else, receives a benefit.

Fees are paid for the specific government service that directly benefits the payer. The payer has a choice of whether to use the service.

Box 7-2 Federal Funding Sources

Several federal actions could provide funding for California integrated water management (IWM). Depending on actions by Congress, funding may be available to the State or local governments. Some of the proposed innovative approaches include:

- **Federal Water Infrastructure Trust Fund.** The Water Infrastructure Trust Fund, if established by Congress, would create a stable and long-term revenue stream to finance water infrastructure projects. The current proposal under consideration is H.R. 3145 and includes over \$10 billion annually with a focus on clean water projects.
- **Water Infrastructure Finance Innovation Act (WIFIA).** The Water Resources and Environment Subcommittee has circulated a draft WIFIA bill (H.R. 3145) and held two hearings on the topic in 2012. One of the main benefits of the proposed program would be to provide low-cost capital to infrastructure projects.
- **National Infrastructure Bank.** An infrastructure bank manages capital and provides loans for infrastructure development. The most recent proposal, H.R. 402, would create a bank similar to the FDIC. The bank would be authorized to issue bonds and subsidies to infrastructure projects, borrow and, in turn, lend to commercial infrastructure projects, and purchase and sell infrastructure loans and securities on the market.
- **Private Activity Bonds.** Congress is considering modifying Private Activity Bond restrictions. Private Activity Bonds are tax-exempt bonds that are available for privately owned water facilities operated by a government unit or charge water rates that are approved by a subdivision of a community. Private agencies are typically not eligible for tax-exempt municipal bonds, which limits access to capital to finance new infrastructure projects.
- **Build America Bonds.** Congress is considering reinstating Build America Bonds. As part of the American Recovery and Reinvestment Act, Congress created Build America Bonds to encourage job creation through infrastructure projects. Eligible projects were not limited to infrastructure and did not allow for private company participation. The bonds stopped being issued in December 2010. Congress is considering reinstating the bonds to target water infrastructure projects.

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Chapter 8. Roadmap For Action

About This Chapter

Chapter 8 provides the *California Water Plan Update 2013* (Update 2013) roadmap to implement Integrated Water Management (IWM) actions. The roadmap considers immediate and changing conditions and priorities, and the ongoing challenges described earlier in Volume 1, and particularly in Chapter 2, “Imperative to Invest in Innovation and Infrastructure.” This chapter presents the elements of the roadmap, namely the vision of sustainable and reliable water resources and management systems. The mission statements herein describe collaborative efforts to prepare for California’s most pressing statewide and regional water management issues and challenges, the seven goals that set forth the desired outcomes of the California Water Plan (CWP), and the 10 guiding principles that express the core values and philosophies for how the vision, mission, and goals will be achieved.

Update 2013 identifies seventeen objectives and their 250-plus related actions and sub-actions geared toward fulfilling the vision, mission, goals, and principles. Performance measures to gauge progress on those related actions are also specified. (For further discussion regarding these elements, see Box 8-1 and Volume 4, *Reference Guide*, the article “Strategic Planning Guidelines.”) The Update 2013 roadmap builds on accomplishments since *California Water Plan Update 2009* (Update 2009), including ongoing implementation of the 2009 comprehensive water legislation, as well as fundamental water-resource management lessons learned. The roadmap includes near-term and long-term actions that describe how Californians can and should step up existing efforts and initiate new ones to provide integrated, reliable, sustainable, and secure water resources and management systems. These efforts will protect public health, public safety, and ecosystems, as well as ensure the stability of the state’s economy, today and for future generations.

Background

Required by the California Water Code Section 10005(a), the CWP is State government’s strategic plan for managing and developing water resources statewide. By statute the CWP cannot mandate actions or authorize spending for the related actions. Update 2013 makes neither project-specific nor site-specific recommendations; therefore, it does not include environmental review and documentation as would be required by the California Environmental Quality Act (CEQA).

Policy-makers and lawmakers must take definitive steps to authorize the related actions in this CWP and appropriate the funding needed for their implementation. At the same time, the plan must be embraced by agencies and voting bodies that can implement the related actions. This underscores the need to have broad public participation and support for the CWP to realize its objectives and related actions.

Update 2013 builds on and advances a planning transformation that began with the *California Water Plan Update 2005* (Update 2005) process. Update 2005 was the first of the CWP updates to explicitly include a strategic planning approach from preparation to presentation. Since then, the CWP has become a strategic planning document that more fully describes the entire role of State government and the growing role of California’s regions in managing the state’s water resources.

PLACEHOLDER Box 8-1 Elements of the Strategic Plan

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of this chapter.]

Elements of the Roadmap

The vision, mission, goals, guiding principles, and objectives and related actions are similar to those presented in Update 2009. In addition, Update 2013 includes four new objectives reflecting important water management topics. These include objectives that promote enhancing public access to waterways, lakes, and beaches; strengthening alignment between land use and water planning; strengthening government agency alignment; and improving water financing. While some related actions for the various objectives were carried over from Update 2009, many were revised or are new for Update 2013.

Vision

California has healthy, resilient watersheds and reliable and secure water resources and management systems. Public health, safety, and quality of life in rural, suburban, and urban communities are significantly improved as a result of advancements in IWM. The water system provides the certainty needed for quality of life, sustainable economic growth, business vitality, and agricultural productivity. California's unique biological diversity, ecological values, and cultural heritage are protected and have substantially recovered.

Mission

Updating the CWP provides federal, State, tribal, regional, and local governments and organizations with a continuous planning forum to collaboratively:

- Recommend strategic goals, objectives, and near-term and long-term actions that would conserve, manage, develop, and sustain California's watersheds, water resources, and management systems.
- Prepare response plans for floods, droughts, and catastrophic events that would threaten water resources and management systems, the environment, and property, as well as the health, welfare, and livelihood of the people of California.
- Evaluate current and future watershed and water conditions, challenges, and opportunities.

Goals

1. California's water supplies are adequate, reliable, secure, affordable, sustainable, and of suitable quality for beneficial uses to protect, preserve, and enhance watersheds, communities, cultural resources and practices, environmental and agricultural resources, and recreation.
2. State government supports integrated water resources planning and management through leadership, oversight, and public funding.
3. Regional and interregional partnerships play a pivotal role in California water resources planning, water management for sustainable water use and resources, and increasing regional self-reliance.
4. Water resource and land use planners make informed and collaborative decisions and implement integrated actions to increase water supply reliability, use water more efficiently, protect water quality, improve flood protection, promote environmental stewardship, and

- 1 ensure environmental justice and public access to water bodies, in light of drivers of change and
- 2 catastrophic events.
- 3 5. California is preparing for climate uncertainty by developing adaptation strategies and investing
- 4 in a diverse set of actions that reduce the risk and consequences posed by climate change,
- 5 which make the system more resilient to change and increase the sustainability of water and
- 6 flood management systems and the ecosystems they depend on.
- 7 6. Integrated flood management, as a part of IWM, increases flood protection, improves
- 8 preparedness and emergency response, enhances floodplain ecosystems, and promotes
- 9 sustainable flood management systems.
- 10 7. The benefits and consequences of water decisions and access to State government resources are
- 11 equitable across all communities.

12 Guiding Principles

- 13 1. Manage California's water resources and management systems with ecosystem health and
- 14 water supply and quality reliability as equal goals, with full consideration of public trust uses.
- 15 Healthy, functioning ecosystems and reliable, quality water supplies are primary and equal
- 16 goals for water management to help sustain water resources and management systems. Protect
- 17 public trust uses whenever feasible, and consider public trust values in the planning and
- 18 allocation of water resources. State government protects the public's rights to commerce,
- 19 navigation, fisheries, recreation, ecological preservation, and related beneficial uses, including
- 20 those of its Native American tribes and other communities that depend on these resources for
- 21 subsistence and cultural practices.
- 22 2. Use a broad, stakeholder-based, long-view perspective for water management. Promote multi-
- 23 objective planning with a regional focus, and coordinate local, regional, interregional, and
- 24 statewide initiatives. Recognize distinct regional problems, resources, assets, and priorities.
- 25 Emphasize long-term planning (30- to 50-year horizon) while identifying near-term actions
- 26 needed to achieve the plan.
- 27 3. Promote sustainable resource management on a watershed basis. Wisely use natural resources
- 28 to ensure their availability for future generations. Promote activities with the greatest multiple
- 29 benefits regionally and statewide. Consider the interrelationship between water supplies, water
- 30 conservation, water quality, water infrastructure, flood protection, energy, recreation, land use,
- 31 economic prosperity, and environmental stewardship on a watershed or ecosystem basis.
- 32 4. Increase system flexibility and resiliency. Evaluate and implement strategies that reduce the
- 33 impacts of droughts and floods in the region. In California, drought contingency planning and
- 34 integrated flood management are important components of regional water planning.
- 35 5. Increase regional self-reliance. Implement resource management strategies that reduce
- 36 dependence on long-term imports of water from other hydrologic regions for meeting additional
- 37 future water demands and during times of limited supply, such as a drought or interrupted
- 38 supply after a catastrophic event (e.g., an earthquake or fire). Reduce reliance on the
- 39 Sacramento-San Joaquin Delta (Delta) in meeting California's future water demands. Increase
- 40 regional self-reliance for water by investing in water use efficiency, water recycling, advanced
- 41 water technologies, local and regional water-supply projects, improved regional coordination of
- 42 local and regional water supplies, and other strategies. As part of a diverse water portfolio,
- 43 short-term water transfers between regions that are environmentally, economically, and socially
- 44 sound can also help increase regional self-reliance overall.

6. Determine values for economic, environmental, and social benefits; costs; and tradeoffs so as to base investment decisions on sustainability indicators. Evaluate programs and projects recognizing economic growth, environmental quality, social equity, and sustainability as coequal objectives. When comparing alternatives, determine the value of potential economic, environmental, and social benefits; beneficiaries; costs; and tradeoffs. Include a plan that avoids, minimizes, and mitigates for adverse impacts.
7. Incorporate future variability, uncertainties, and risk in the decision-making process. Use multiple future scenarios to consider drivers of change and emerging conditions, such as population growth and climate change, when making planning, management, and policy decisions.
8. Apply California's water rights laws, including the longstanding constitutional principles of reasonable use and public trust, as the foundation for public policy-making, planning, and management decisions on California water resources. Recognize that certain natural resources — including water, tides, and submerged lands; the beds and banks of navigable rivers; and fish and wildlife resources — are owned by the public and held in trust for present and future generations of Californians. Native American tribes also depend on these natural resources for subsistence and cultural heritage. Effectively applying existing water rights laws and the twin principles of reasonable use and public trust will provide water for future generations while protecting ecosystem values.
9. Promote environmental justice — the fair treatment of people of all races, cultures, and incomes. Include meaningful community participation in decision-making for State-sponsored or public-funded resource management projects, and consider such factors as community demographics, potential or actual adverse health or environmental impacts, and benefits and burdens of the project on stakeholder groups.
10. Use science, best data, and local and traditional ecological knowledge in a transparent and documented process. When appropriate and possible, use data, information, planning methods, and analytical techniques that have undergone scientific review.

Objectives and Related Actions

The objectives and related actions presented in this roadmap were developed in part from companion state plans and the Tribal Engagement Plan (refer to Chapter 4, “Strengthening Government Alignment”). Meeting the 17 objectives, shown in Box 8-2, will help achieve the CWP goals. Planning and investing in the more than 250 related actions and sub-actions will provide greater system resiliency and help California deal with climate conditions and other future uncertainties and risks. (Note that numbering of the objectives and related actions, below, is for ease of identification and does not represent priority.)

PLACEHOLDER Box 8-2 Update 2013 Objectives

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of this chapter.]

Objective 1 — Strengthen Integrated Regional Water Management Planning



Strengthen integrated regional water management planning to improve regional self-reliance, and maintain and enhance regional water management partnerships.

The broad purpose of integrated regional water management (IRWM) is to promote a regional planning and implementation framework to comprehensively address water supply, quality, flood, and ecosystem challenges. IRWM also seeks to implement integrated solutions through a collaborative multi-partner process that includes water managers; tribes; non-governmental organizations; federal, State, and local governments; and disadvantaged communities. Over the past 10 years, IRWM has profoundly improved water management in California, and looking ahead there are opportunities for even greater advancement.

The California Department of Water Resources (DWR) is currently exploring these opportunities by developing the Strategic Plan for the Future of Integrated Regional Water Management in California. This plan, expected to be completed in 2014, will help shape the desired future for IRWM and identify measures needed for that future to be achieved. Since the Strategic Plan for the Future of IRWM in California is a companion state plan for the CWP, these measures will likely be incorporated as related actions under this objective as part of Update 2013.

Additional information on the development of the Strategic Plan for the Future of IRWM in California is available at the following Web site: <http://www.water.ca.gov/irwm/stratplan/>.

Related Actions



[Note: These related actions are under development and will include actions and recommendations from the IRWM Strategic Plan, when available.]

PLACEHOLDER Table 8-1 Related Actions and Performance Measures for Objective 1 (Strengthen Integrated Regional Water Management Planning)

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of this chapter.]

Objective 2 — Use and Reuse Water More Efficiently

Use water more efficiently with significantly greater water conservation, recycling, and reuse to help meet future water demands and adapt to climate change.

Urban and agricultural water use efficiency are important tools for meeting current and future water demands and maximizing beneficial use of the state's water resources. To minimize the impacts on California's natural environment and support meeting statewide and local water demands, our cities and farms must continue to increase water use efficiency to maximize benefits from existing and future water supplies. Californians have been successful in increasing water-use efficiency measures, such as low water-use landscaping, water-efficient appliances, and municipal wastewater recycling; however, increasing population and climate change impacts require continued aggressive focus and investment in water-use efficiency efforts.

Key components of California's actions to increase water use efficiency are contained within the 2009 Comprehensive Water Package (Senate Bill [SB] X7-7), which requires urban water agencies to reduce statewide per capita water consumption 20 percent by 2020 and make incremental progress toward this goal by reducing per capita water use by at least 10 percent on or before December 31, 2015. The bill also requires agricultural water suppliers to measure water deliveries and adopt a pricing structure for water customers based in part on quantity delivered, and, where technically and economically feasible, to implement additional measures to improve efficiency.

Water use efficiency is a fundamental component of California water planning because it integrates and benefits key components of water supply planning and environmental stewardship. It is a key part of the water management portfolio of every water agency, city, county, farm, and business, including State and federal government agencies. Water use efficiency and conservation reduce water demand and, in turn, wastewater generation. This reduces water and wastewater treatment needs, thereby reducing energy demand and greenhouse gas (GHG) emissions. Efficient water use also includes the development of local water supplies, which has the dual benefit of reducing energy demands for water transportation and reducing reliance on water supplies that may be strongly influenced by fluctuating availability. Efficient water use also matches water quality to water use (“fit for use”), primarily to identify water reuse opportunities that minimize the need for high-level and energy-intensive treatment. While these water management issues have statewide impacts, they are primarily implemented at the local and regional levels.

The related actions identified below are specific measures that can be implemented during the term of Update 2013 to support this objective of using and reusing water more efficiently. They focus on increased water education to continue to raise awareness of the need for all Californians to be efficient with use of our shared resource, development of agricultural and urban water tools and metrics, and preparation of a statewide recycled water strategic plan.

Related Actions

2.1 The State should expand public information efforts to promote water conservation in both the urban and agricultural sectors to better inform all Californians about the importance and value of water and about ways to use water more efficiently. The expanded campaign should be designed with specific informational goals and objectives and should operate on a continuous basis in wet years as well as dry years. This campaign will assist local water suppliers and the State in achieving the 2020 water use targets.

2.2 DWR, with the California Urban Water Conservation Council (CUWCC) and the State Water Resources Control Board (SWRCB), should research and promote water rate structures that provide conservation price signal to customers while maintaining revenue stability for the water utilities.

2.3 DWR, with the SWRCB and California Department of Public Health (CDPH), should prepare a California Municipal Water Recycling Strategic Plan to guide expanded statewide use of recycled water to help sustain statewide water supplies. The strategic plan will include:

2.3.1 Review and status of implementation of the 2003 Recycled Water Task Force findings.

2.3.2 Regional assessment and quantification of current and proposed recycled water capacities and demands.

2.3.3 Evaluation of better alignment of the level of treatment required for recycled water use in agricultural and environmental applications to create more opportunities for recycled water use and reduce the energy required to produce recycled water.

2.3.4 Consideration of potential groundwater degradation issues and coordination with Salt and Nutrient Management Plan implementation.

2.3.5 Regional evaluation of barriers to additional recycled water use and proposing solutions, including indirect and direct potable reuse issues, to support continued expansion of recycled water use.

- 2.4 The State should establish a water use efficiency and alternative supply research program to speed the development, testing, and implementation of promising new technology and approaches to water management. The program should conduct studies in all sectors of water use, including agriculture, municipal and industrial, and in the alternative supply areas of recycling, greywater, stormwater capture, and desalination. The level of sponsored research should match that of the State's energy-use efficiency research programs.
- 2.5 DWR should research and assist water suppliers in using new tools to measure landscape area. The landscape area data can be used to establish water budgets for customer accounts. Water suppliers can use the water budget program to better focus their water conservation efforts toward customers who are using excess water.
- 2.6 DWR, in cooperation with urban water-use community, should conduct a study to identify the barriers, costs, and technical assistance required to establish standard urban water-use classifications for water use reporting. The standard classifications would allow for water supplier data to be more accurately aggregated at the regional and statewide levels and permit a more detailed and accurate reporting of California water use.
- 2.7 Agricultural and urban water suppliers should report water supply system leakage and spills in their water management plans. Agricultural suppliers should measure and report canal seepage and district outflows. Urban water suppliers should calculate and report unaccounted-for distribution system water.
- 2.8 All levels of government should establish policies and provide incentives to promote better urban runoff management and reuse. Urban and, where feasible, rural communities should invest in facilities to capture, store, treat, and use urban stormwater runoff, such as percolation to usable aquifers, underground storage beneath parks, small surface basins, in drains, or the creation of catch basins or sumps downhill of development. Depending on the source and application, captured stormwater may be suitable for use without additional treatment, or it may be blended to augment local supplies.

**PLACEHOLDER Table 8-2 Related Actions and Performance Measures for Objective 2
(Use and Reuse Water More Efficiently)**

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of this chapter.]

Objective 3 — Expand Conjunctive Management of Multiple Supplies

Advance and expand conjunctive management of multiple water supply sources with existing and new surface and groundwater storage to prepare for future droughts, floods, and climate change.

California can prepare for future droughts, flood, and climate change, as well as improve water supply reliability and water quality, by managing the extensive water storage capacity of groundwater basins in closer coordination with existing and new surface storage and other water supply sources when available. The other supply sources include, but are not limited to, recycled municipal water, surface runoff and

floodflows, urban runoff and stormwater, imported water, water transfers, and desalination of brackish and sea water.

Surface and groundwater resources must be managed much more conjunctively when feasible to meet the challenges of climate change. Additional water storage and conveyance improvements are also necessary to provide better flood management, water quality, and system reliability in response to daily and seasonal variations and uncertainties in water supply and use, and to facilitate water transfers within and among regions.

During droughts, California has historically depended on its groundwater. However, many aquifers are contaminated, requiring remediation if they are to be used as viable water banks. Moreover, groundwater resources will not be immune to climate change; in fact, historical patterns of groundwater recharge may change considerably as a result of climate change. Because droughts may be exacerbated by climate change, more efficient groundwater basin management will be necessary to minimize additional groundwater depletion and to utilize opportunities to store water underground and substantially reduce existing overdraft.

Along with more effective use of groundwater storage, better regional and systemwide water management and the reoperation of surface storage reservoirs and related infrastructure of flood and water management systems can provide many benefits in a changing climate. These include capturing higher peak flows to protect beneficial uses of water, such as protecting drinking water quality, providing cold water releases for fish, preventing seawater intrusion, generating clean hydroelectricity, providing recreational opportunities in a warmer climate, and offsetting the loss of snowpack storage by facilitating increased storage of water above and below the ground.

System reoperation of existing flood and water infrastructure will require the active cooperation of many agencies, local governments, and landowners. Successful system reoperation will require that the benefits are evident to federal, tribal, regional, and local partners. Systemwide operational coordination and cooperation need to occur in advance of responding to extreme hydrologic events that may become larger and more frequent with climate change.

Related Actions

3.1 Promote public education about California's groundwater.

3.2 Improve collaboration and coordination among federal, State, tribal, regional, and local agencies and organizations to ensure data integration, coordinate program implementation, and minimize duplication of efforts.

3.3 Increase availability and sharing of groundwater information.

3.4 Strengthen and expand the California Statewide Groundwater Elevation Monitoring (CASGEM) Program for its long-term sustainability.

3.5 Under the CASGEM Program, improve understanding of California groundwater basins by conducting groundwater basin assessments of CASGEM high-priority basins in conjunction with the CWP 5-year production cycle.

- 3.6 Conduct an assessment of all SB 1938 groundwater management plans and develop guidelines to promote best practices in groundwater management.
- 3.7 Develop analytical tools to assess conjunctive management and groundwater management strategies.
- 3.8 Increase statewide groundwater recharge and storage by two (2) million acre-feet (maf) (current average annual statewide groundwater use is about 16 maf).
- 3.9 Evaluate reoperation of the state's existing water supply and flood control systems.
- 3.10 DWR and the U.S. Bureau of Reclamation (USBR) should:
 - 3.10.1 Complete the North-of-the-Delta Offstream Storage, Shasta Lake Water Resources, and Upper San Joaquin River Basin Storage investigations.
 - 3.10.2 Complete the investigation of the further enlargement of the Los Vaqueros Reservoir.
 - 3.10.3 USBR, in collaboration with DWR, should complete an investigation to enlarge/raise BF Sisk Dam and San Luis Reservoir.

PLACEHOLDER Table 8-3 Related Actions and Performance Measures for Objective 3
(Expand Conjunctive Management of Multiple Supplies)

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of this chapter.]

Objective 4 — Protect and Restore Surface Water and Groundwater Quality

Protect and restore surface water and groundwater quality to safeguard public and environmental health and secure California's water supplies for beneficial uses.

As California's population continues to grow and climate change impacts continue to occur, greater demands will be made on the available water supply, and threats to water quality from known and emerging pollutants will increase, potentially causing further impairments to the waters and their uses. When water quality is impaired, the state is deprived of critical water supplies needed to support its growing population, vital economy, and the environment. Protecting and restoring water quality ensures that water supplies are available for all beneficial uses and all communities. It is also a crucial element of IWM and essential to maintaining healthy watersheds.

Healthy watersheds, or drainage basins, that provide clean and plentiful surface water and groundwater, and support healthy riparian and wetland habitat, are essential to support California's resources and economic future. A watershed approach is hydrologically focused; recognizes the degree to which groundwater and surface water bodies are connected physically; is aware of the linkages between water quantity and water quality; and requires a comprehensive, long-term approach to water resources management that takes system interactions into account. State government efforts to protect and restore water quality are essential but alone cannot support a comprehensive watershed protection approach. Success depends on the integration of federal, State, tribal, regional, and local programs and projects, including land use decisions made by local officials, stakeholder involvement, and the actions of millions of individuals, which, when taken together, can have significant impacts and make a difference.

Related Actions


4.1 Protect and restore surface water quality by implementing strategies to protect the past, present, and probable future beneficial uses for all 2010-listed (Clean Water Act, Section 303[d]) water bodies by 2030.

4.1.1 Implement a statewide strategy to efficiently prepare, adopt, and implement total maximum daily loads (TMDLs), which result in water bodies meeting water quality standards, and adopt and begin implementation of TMDLs for all 2010-listed water bodies by 2019.

4.1.2 Manage urban runoff volume to reduce pollutant loadings, reduce wet weather beach postings and closures by 75 percent by 2020, eliminate dry weather beach closures and postings and, where applicable, promote stormwater capture and re-use for development of sustainable local water supplies.

4.1.3 Take appropriate enforcement actions and innovative approaches as needed to protect and restore the beneficial uses of all surface waters.

4.2 Protect and restore groundwater quality by improving and protecting groundwater quality in high-use basins by 2030.

 4.2.1 **Communities** should implement an integrated groundwater protection approach to improve and protect groundwater in high-use basins that:

A. Evaluate and regulate activities that impact or have the potential to impact beneficial uses.


B. Recognize the effects of groundwater and surface water interactions on groundwater quality and quantity.

C. Encourage and facilitate local management of groundwater resources.

4.2.2 State government should identify strategies to ensure that communities with contaminated groundwater have a clean and reliable drinking water supply, which may include remediation of polluted or contaminated groundwater, surface water replacement, and/or groundwater treatment.

4.2.3 State government should implement the recommendations in the SWRCB's Report to the Legislature on addressing issues associated with nitrate contaminated groundwater.

4.2.4 The SWRCB and Regional Water Quality Control Boards (RWQCBs) should maintain high-quality groundwater basins through application of antidegradation directives using waste discharge requirements (WDRs) and the remediation of polluted or contaminated groundwater.

 4.2.5 **Regional and local stakeholders** should prepare salt and nutrient management plans for each groundwater basin/subbasin in California by 2016. These salt/nutrient management plans should be prepared as outlined in the SWRCB's Water Quality Control Policy for Recycled Water adopted May 14, 2009, the purpose of which is to increase the use of recycled water from municipal wastewater sources that meets the definition in California Water Code section 13050(n), in a manner that implements State and federal water quality laws. The RWQCBs should incorporate salt and nutrient management plans into basin plans, where appropriate.

4.3 Comprehensively address water quality protection and restoration, and the relationship between water supply and water quality, and describe the connections between water quality, water quantity, and climate change, throughout California's water planning processes.

4.3.1 As part of the CWP, the SWRCB should prepare a comprehensive water quality policy to guide the State's water management activities, including protection and restoration of water quality through the integration of statewide policies and plans, regional water quality control plans (basin plans), and the potential effects of climate change on water quality and supply.

- 4.3.2 RWQCBs should consistently organize basin plans to provide a clear structure that readily conveys key elements (e.g., beneficial uses, potential impacts of climate change, water quality objectives, goals for watersheds, plans for achieving those goals, and monitoring to inform and adjust the plans) and that fully integrates other water quality control plans, such as the California Ocean Plan and Water Quality Control Plan for Enclosed Bays and Estuaries.
- 4.3.3 RWQCBs should adopt basin plan amendments through a collaborative process that involves third parties and incorporates SWRCB requirements and stakeholder interests. An example is the Santa Ana RWQCB's Basin Plan amendment initiated with funding assistance from stakeholders as required in the SWRCB's Recycled Water Policy.
- 4.3.4 State Government should continue to support efforts of the California Water Quality Monitoring Council to develop a centralized Geographic Information System (GIS) database (EcoAtlas) that displays watershed information, including watershed boundaries, TMDLs, monitoring data, water body types, assigned BUs, wetlands, California Rapid Assessment Method scores, vegetation types, and other data. A key component of effective water quality planning is access to pertinent watershed information so that regulatory actions can strategically protect and improve watershed aquatic resources.
- 4.4 To protect source water and safeguard water quality for all beneficial uses, State government should implement the recommendations from the following CWP Resource Management Strategies found in Volume 3: pollution prevention, matching water quality to use, salt and salinity management, urban stormwater runoff management, groundwater/aquifer remediation, recharge area protection, municipal recycled water, and drinking water treatment and distribution.
- 4.5 CDPH will continue to implement its Small Water System Program Plan to assist small water systems (especially those serving disadvantaged communities) that are unable to provide water that meets primary drinking water standards.
- 4.5.1 CDPH will share the Small Water System Program Plan with relevant federal, tribal, State, regional, and local agencies, as well as stakeholders, to foster additional opportunities for funding, coordinate construction projects in communities, and to assist in local and regional planning efforts.
- 4.5.2 CDPH will utilize GIS tools to identify large water systems in close proximity to targeted small water systems, and conduct targeted outreach to these large water systems to encourage them to consolidate the small systems into their service area.
- 4.5.3 CDPH will work with stakeholders to identify obstacles to consolidation (including financial, legal, and local issues) and develop possible actions to address these obstacles.
- 4.5.4 CDPH will participate in statewide planning efforts to address the water infrastructure needs of small water systems. CDPH should seek input from other states and the federal government on innovative, successful efforts to address the needs of small water systems, and should share its results on implementation of its Small Water System Program Plan.

**PLACEHOLDER Table 8-4 Related Actions and Performance Measures for Objective 4
(Protect and Restore Surface Water and Groundwater Quality)**

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of this chapter.]


Objective 5 — Practice Environmental Stewardship

Practice, promote, improve, and expand environmental stewardship to protect biological diversity and sustain natural water and flood management systems in watersheds, on floodplains, and in aquatic habitats.


California has lost more than 90 percent of the wetlands and riparian forests that existed before the Gold Rush. Successful restoration of aquatic, riparian, and floodplain species and natural communities ordinarily depends on at least partial restoration of physical processes that are driven by water. These processes include the flooding of floodplains, the natural pattern of erosion and deposition of sediment, the balance between infiltrated water and runoff, and large seasonal variation in stream flow. Reduction of these physical processes often leads to displacement of native species by exotic species, which presents another huge barrier to ecosystem restoration.

Water supply and flood management projects that preserve, enhance, and restore biological diversity and ecosystem processes are likely to be more sustainable — operating as desired with less maintenance — than those that do not. Projects are more sustainable when they work with, rather than against, natural processes that distribute water and sediment. To include ecosystem restoration in a project usually requires a degree of return to more natural patterns of erosion, sedimentation, flooding, and stream flow, among others. This, in turn, makes such projects less susceptible to the effects of catastrophic events and minimizes the cost and effort of maintenance.

Related Actions

5.  Governments and the private sector should work together to create and maintain a network of protected reserve areas across the state that builds on existing conservation investments, and provides refuge areas and migration corridors that allow species to adjust to conditions associated with climate change. The network should include river corridors that connect high elevations to valleys and reestablish natural hydrologic connections between rivers and their historic floodplains. (California Natural Resources Agency 2009)

5.1.1 The California Natural Resources Agency should develop and implement a comprehensive tracking system to identify the lands that already are protected and lands that are a priority for protection.

 2 **All agencies** that own and operate water and flood management systems should include actions in their respective natural resource management plans that restore natural processes of erosion and sedimentation in rivers and streams and increase the quantity, diversity, quality, and connectivity of riverine and floodplain habitats. Local planning activities, including integrated regional water management (IRWM), urban water management plans, watershed management plans, natural community conservation plans, habitat conservation plans, and other water resource or floodplain focused planning efforts, should include objectives to meet these goals.

5.2.1 Re-establish one million acres of contiguous natural riparian, wetland, and floodplain habitat that is subject to periodic flooding for at least 50 percent of the river miles in the regions. This can contribute to Assembly Bill (AB) 32 GHG reduction goals through enhanced carbon sequestration. IRWM and regional flood management plans that incorporate corridor connectivity and restoration of native aquatic and terrestrial habitats to support increased biodiversity and resilience to a changing climate should receive additional credits in State government water and flood grant programs. (See objectives 1, 2, and 6)

- 5.3 State and federal governments should encourage, prioritize, and identify financing for actions to protect, enhance, and restore at least one million acres of upper watershed forests and meadows that act as natural water and snow storage. These actions should include efforts to reduce the risks and impacts of catastrophic wildfire. This measure improves water supply reliability, protects water quality, safeguards high-elevation habitats, and supports carbon sequestration and forest-based economies. (See objectives 1, 3, and 4.) (Association of California Water Agencies 2013; California Air Resources Board 2008)
- 5.4 Governments and the private sector should develop and support programs that pay private landowners and managers to protect and improve habitat and nature's water-related services, including flood protection, water quality, groundwater recharge and storage, reversal of land subsidence, prevention of large wildfires, shading of rivers and streams, and reduced soil erosion.
- 5.5 Governments and the private sector should work to incorporate the economic value of nature's goods and services into natural resource management decisions. Such recognition should include development of ways to measure the economic value of those services and the financial return from investment in their protection and enhancement.
- 5.6 Federal, state, and local agencies should provide greater resources and coordinate efforts to control invasive species and prevent their introduction. (California Department of Fish and Game 2007)
- 5.7 State and federal government should work with dam owners/operators, tribes, and other stakeholders to evaluate opportunities and technologies to reintroduce anadromous fish to upper watersheds. Re-establishment of anadromous fish upstream of dams may provide flexibility in providing cold water downstream in conjunction with water and flood systems reoperation strategies. The State and federal governments should develop funding sources to support partnerships in constructing fish passage at dams and to assist removal of obsolete dams that pose a public safety and ecological risk.
- 5.8 State, federal, and local government should identify and prioritize protection of lands of San Francisco Bay and the Delta that will provide the habitat range for tidal wetlands to adapt to and shift with sea level rise. A climate change resilient San Francisco Bay and Delta should include creating greater flood capacity by construction of setback levees on islands and removal of strategic island levees that also creates opportunities for tidal wetland and riparian restoration. Such lands and actions can help maintain estuarine ecosystem functions and act as storm buffers, protecting people and property from flood damages. (San Francisco Estuary Partnership 2007)
- 5.9 State government should prioritize and expand Delta islands and Suisun Marsh subsidence reversal and land accretion projects to help reestablish equilibrium between land and estuary elevations. Sediment-soil accretion is a cost-effective, natural process that can help sustain the Delta and Suisun Marsh ecosystem, and reduce communities' risks from flooding, as well as sequester carbon and restore estuarine ecosystem functions.
- 5.10 State and federal government should fund natural resource protection agencies to continue work to determine fishery needs and provide funds for water right holders to meet those needs.

**PLACEHOLDER Table 8-5 Related Actions and Performance Measures for Objective 5
(Practice Environmental Stewardship)**

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of this chapter.]

Objective 6 — Improve Flood Management Using an Integrated Water Management Approach

Promote and practice flood management that reduces flood risk to people and property and maintains and enhances natural floodplain functions using an IWM approach. An IWM approach utilizes a systemwide perspective and considers all aspects of water management, including public safety and emergency management, environmental sustainability, and economic stability (which includes water supply reliability, water quality, and system and community resiliency).

Flood management has traditionally had the single purpose of protecting people and property that could be harmed by flood waters by separating them from the flood. In contrast, flood management using an IWM approach seeks to protect people and property exposed to flooding, while also addressing the quality and functioning of ecosystems, the reliability of water supply and water quality, and economic stability (including both economic and cultural considerations). This shift changes the focus of flood management from managing flood water to managing floodplains, thus allowing for both a local and a systemwide context.

Today, one in five Californians live in a floodplain. There are more than 20,000 miles of levees, over 1,500 dams, more than 1,000 debris basins, and other facilities statewide that manage flood water and provide flood risk reduction. Traditionally, Californians have reduced the risk of flooding through actions like building dams, levees, and other facilities that constrain floodwaters and provide protection to people from the harmful aspects of flooding, but these facilities also diminish the natural benefits of floods. These facilities face a number of challenges, including reaching the end of their useful life, inadequate operations and maintenance, insufficient capacities, and stressors resulting from climate change. Climate change may cause sea levels to rise, produce higher tides, shift precipitation patterns toward more intense winter storms, and produce higher peak flows, thereby increasing the state's flood risk.

A collection of laws passed in 2007 and 2008 focused attention on flooding and the risks it poses. These laws intended to promote a new perspective for managing floods. Despite the amount of progress and improvements that have been made since the passage of these laws, Californians still face an unacceptable level of flood risk. Current infrastructure strains to meet existing objectives, and changing climatic conditions could exacerbate this situation. With climate change and other changing conditions, improving system flexibility and adaptability must be a fundamental tactic, especially with respect to water and flood system operations and management (see Objective 3).

Flood management is evolving from narrowly focused traditional approaches toward an IWM approach. This more integrated approach includes a mix of structural and non-structural approaches to reduce flood risk and enhance the ability of undeveloped floodplains and other open spaces to behave more naturally to absorb, store, and slowly release floodwaters during small and medium-size events. Flood management using an IWM approach considers land and water resources on a watershed scale to maximize the benefits

of floodplains; minimize loss of life and damage to property from flooding; recognize the benefits to ecosystems from periodic flooding; and provide other potential benefits, such as water supply reliability, water quality improvements, and increased recreation opportunities. Flood management using an IWM approach extends the range of resource management strategies that could be employed and leads to addressing a wide variety of needs. Using an IWM approach encourages an increased understanding of the cause and effect of different management actions. Additionally, the IWM approach is tailored to the physical attributes of a hydrologic region or watershed; the presence of undeveloped floodplains; the type of flood hazards (e.g., riverine, alluvial fan, coastal); and the areal extent of flooding.

An IWM approach requires unprecedented alignment and cooperation among public agencies, tribal entities, land owners, interest-based groups, and other stakeholders. This approach relies on blending knowledge from a variety of disciplines, including engineering, planning, economics, environmental science, public policy, and public information. It is not a one-time activity but rather an ongoing process. The following table of actions provides recommendations for improving flood management by using an IWM approach.

Related Actions

6.1 Agencies at all levels should utilize IWM principles that consider flood risk, mitigation, and protection of natural floodplain functions for planning and implementing flood management projects. Collaborate with planners, engineers, scientists, regulators, and other stakeholders to identify flood risk reduction and floodplain restoration strategies that can be used in local and regional planning efforts such as general plans, regional economic and transportation plans, resource conservation plans, floodplain management plans, and others. This should include best management practices (BMPs) for coastal zones, alluvial fans, headwaters, and riverine floodplains in urbanized and non-urbanized areas.

6.2 The State should prepare an update to the 2013 California's Flood Future Report: Recommendations for Managing the State's Flood Risk (California's Flood Future), which further advances the recommendations developed as part of the original California's Flood Future effort.



3 Local agencies should work together in regions to develop regional flood risk assessments to evaluate potential adverse impacts of flooding on life, property, infrastructure, the environment, and the economy. The risk assessments should be developed through regional collaboration among local, state, and federal stakeholders, and based on a consistent methodology, appropriate to the region, for flood risk assessment. This assessment should include a determined acceptable level of flood risk for people, property, and the environment within the region. The flood risk assessments should include a set of digital maps for planning and communication of flood risk to agencies, the public, elected officials, and other stakeholders.

6.4 The State should develop comprehensive economic evaluation guidance for flood risk assessment and other flood management activities. The economic evaluation guidance should include methods to evaluate ecosystem services and other IWM benefits and should be adaptable to different areas of the state.



5 Local agencies should work together regionally to develop regional flood risk management plans based on regional risk assessments and define short-term and long-term goals, objectives, actions, and

associated implementation strategies for reducing flood risk, as well as define opportunities to enhance natural floodplain functions and provide other IWM benefits. These plans should reflect a collaborative, stakeholder-based process addressing the unique regional and statewide interests, critical needs, and priorities. These plans should address, as appropriate: the locally identified level of flood protection; flood risk and flood damage reduction and mitigation strategies, including natural floodplain function; operations and maintenance; and local, regional and state IWM strategies.

6.6 The State should work with federal and local agencies to develop a statewide flood management investment approach. This approach would evaluate short- and long-term financing needs, as well as available investment strategies, and should lay out potential future investment alternatives for flood management statewide. This action will also be informed by the outcomes of Objective 17.

6.7 The State should take appropriate action to facilitate revenue generation and support regional flood risk management. This includes an evaluation of existing financing mechanisms and legal frameworks to facilitate the development of regional flood-risk reduction financing.

6.8 The State should work with stakeholders to develop BMPs for land use planning that achieve flood risk reduction and protection of natural floodplain functions. The State should collaborate with planners, engineers, scientists, regulators, and other stakeholders. BMPs should be developed for local planning (e.g., general plans, land use regulations) that is conducted by cities and counties and for regional planning (e.g., sustainable communities strategies and blueprint plans) that is conducted by regional planning agencies. Land use planning BMPs should be developed for coastal zones, alluvial fans, headwaters, and riverine floodplains in urbanized and non-urbanized areas.

6.9 The State should work with federal and local agencies to develop a comprehensive regional vulnerability analysis approach and set of regional adaptation strategies for climate change impacts on flood risk and floodplain ecosystems.

6.10 The State should create and coordinate statewide and regional environmental regulatory working groups to improve and streamline regulatory review processes that will address critical flood risk reduction projects, flood system maintenance, flood emergency response, and floodplain restoration (see Objective 16). State and federal environmental regulatory agencies, in collaboration with regional stakeholders, should take actions to streamline regulatory review while recognizing the unique differences among geographical regions of the state.

6.11 The State should develop a comprehensive set of materials and tools to assist public agencies in obtaining accurate information on flood risk and floodplain conditions and increase public awareness of flood risks and potential IWM solutions in that region. The State should develop regional and statewide indicators of flood risk and floodplain conditions and create online regional and statewide flood risk and floodplain information resources for government agencies and for the public. These resources should include regional maps with information on flood risk and floodplain conditions and indicators; outreach and communication tools, including tailored outreach materials as needed to meet the unique needs of each region; and materials that clarify the roles and responsibilities of local, state and federal agencies in flood risk reduction and floodplain restoration efforts, including emergency response.

- 6.12 The State should increase support for flood emergency preparedness, response, and recovery programs to reduce flood risk by identifying data and forecasting needs; conducting statewide flood emergency management (EM) exercises; working with locals to improve flood EM plans; and supporting increased coordination between flood EM responders, planners, facility managers, and resource agencies. (See Objective 8).
- 6.13 In June 2012, the Central Valley Flood Protection Board adopted the first Central Valley Flood Protection Plan (CVFPP). Prepared by DWR, the plan presents a long-term vision for improving integrated flood management in the Central Valley and achieving a more flexible, resilient, and sustainable flood management system over time. In implementing this vision, the State should take the following actions consistent with the goals of the CVFPP:
- 6.13.1 Update the CVFPP in years ending in 2 and 7.
 - 6.13.2 Continue to work with local and regional entities and the federal government to plan and refine physical improvements to the State Plan of Flood Control.
 - 6.13.3 Periodically update the Flood Control System Status Report (FCSSR), which provides information on the current status and conditions of State Plan of Flood Control facilities.
 - 6.13.4 Continue to develop criteria and guidance to assist local cities and counties in demonstrating an urban level of flood protection consistent with State law.
 - 6.13.5 Continue to develop policies, guidance, and funding mechanisms to implement flood management projects by using an IWM approach in the Central Valley.
 - 6.13.6 Continue to develop guidance and take actions to support wise management of floodplains and residual flood risks present in floodplains protected by the State Plan of Flood Control.
- 6.14 In May 2013, the Delta Stewardship Council adopted the Delta Plan. The Delta Plan was developed to guide State and local agencies to help achieve the coequal goals of providing a more reliable water supply for California and protecting, restoring, and enhancing the Delta ecosystem. To support the implementation of the Delta Plan, the following flood-related actions should be taken:
- 6.14.1 The Legislature should establish a Delta Flood Risk Management Assessment District with fee authority (including over State infrastructure).
 - 6.14.2 The Legislature should fund the State to evaluate and implement a bypass and floodway on the San Joaquin River near Paradise Cut.
 - 6.14.3 The State should evaluate whether additional areas both within and upstream of the Delta should be designated as floodways and should include the consideration of the anticipated effects of climate change in these areas.
 - 6.14.4 The State should develop criteria to define locations for future setback levees in the Delta and Delta watershed.
 - 6.14.5 The Legislature should require adequate levels of flood insurance for residences, businesses, and industries in flood-prone areas.
 - 6.14.6 The Legislature should consider statutory and/or constitutional changes that would address the State's potential flood liability.
 - 6.14.7 The U.S. Army Corps of Engineers (USACE) should consider a variance that exempts Delta levees from the USACE's levee vegetation policy.
 - 6.14.8 State and local agencies and regulated utilities that own and/or operate infrastructure in the Delta should prepare coordinated emergency response plans to protect the infrastructure from long-term outages resulting from failures of the Delta levees. The emergency procedures should consider methods that also would protect Delta land use and ecosystem.

**PLACEHOLDER Table 8-6 Related Actions and Performance Measures for Objective 6
(Improve Flood Management Using an Integrated Water Management Approach)**

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of this chapter.]

Objective 7 — Manage the Delta to Achieve the Coequal Goals for California

Manage the Delta as both a critically important hub of the California water system and as California’s most valuable estuary and wetland ecosystem. Achieve the two coequal goals of providing a more reliable water supply for California and protecting, restoring, and enhancing the Delta ecosystem in a manner that protects and enhances the unique cultural, recreational, natural resource, and agricultural values of the Delta as an evolving place.

After years of slow decline, the condition of the Delta’s watery ecosystem, as measured especially by the population of wild salmon and other native fishes, has gone critical. Today, all those who depend on or value the Delta are, in a word, afraid. Delta residents face the possibility of floods from the east when the rivers flow strongly and of salinity intrusion from the west if they flow feebly. Fishermen, both commercial and recreational, fret about the future of salmon and other species. Water suppliers that receive water from the Delta find those supplies insecure and subject to interruption by weather vagaries, levee failures, or pumping restrictions imposed in the desperate attempt to stem the decline of fish.

In 2009, the Legislature made its latest, most determined bid to find solutions, passing the Delta Reform Act and associated bills. First and foremost, it declared that State policy toward the Delta must henceforth serve two “coequal goals” (see Box 8-3):

- Providing a more reliable water supply for California.
- Protecting, restoring, and enhancing the Delta ecosystem.

These goals, the Legislature added, must be met in a manner that:

- Protects and enhances the unique cultural, recreational, natural resource, and agricultural values of the Delta as an evolving place.

By affirming the equal status of ecosystem health and water supply reliability, the Legislature changed the terms of the conversation. It changed them further with the following pronouncement: “The policy of the State of California is to reduce reliance on the Delta in meeting California’s future water supply needs.” Here was recognition that, for the sake of the water system and the Delta both, a partial weaning of the one from the other is required.

With the package of 2009 water bills, the Legislature also established the Delta Stewardship Council with a mandate to resolve long-standing issues and to develop a Delta Plan. The Delta Plan is California’s plan for the Delta, prepared in consultation with, and to be carried out by, all agencies in the field: the SWRCB, which allocates water rights and protects water quality; DWR, which is the State’s water planner and operator of the State Water Project; the California Department of Fish and Wildlife (DFW), which is responsible for the welfare of the living system of the Delta; the Delta Protection Commission, which oversees land use and development on low-lying Delta islands; and many more agencies, State and local.

PLACEHOLDER Box 8-3 Delta Policy on Coequal Goals

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of this chapter.]

Related Actions

7.1 State or local public agencies undertaking covered actions must file certifications of consistency with the Delta Stewardship Council. Certifications of Consistency must include detailed findings that demonstrate how the covered action is consistent with all the policies of the Delta Plan.

7.2 Provide a more reliable water supply for California by implementing the following:

7.2.1 All water suppliers should fully implement applicable water efficiency and water management laws, including urban water management plans; the 20 percent reduction in statewide urban per capita water usage by 2020; agricultural water management plans; and other applicable water laws, regulations, or rules.

7.2.2 DWR, in consultation with the Delta Stewardship Council, the SWRCB, and others, should develop and approve guidelines for the preparation of a water supply reliability element as part of the update of an urban water management plan, agricultural water management plan, integrated water management plan, or other plan that provides equivalent information about the supplier's planned investments in water conservation and water supply development. The expanded water supply reliability element should include the details recommended in the Delta Plan. **Water suppliers that receive water from the Delta watershed should include an expanded water supply reliability element in their water management plans, starting in 2015.**

7.2.3 DWR and the SWRCB should establish an advisory group with other state agencies and stakeholders to identify and implement measures to reduce impediments to achievement of statewide water conservation, recycled water, and stormwater goals. This group should evaluate and recommend updated goals for additional water efficiency and water resource development.

7.2.4 DWR, the SWRCB, the CDPH, and other agencies, in consultation with the Delta Stewardship Council, should revise State grant and loan ranking criteria to be consistent with Water Code section 85021 and to provide a priority for water suppliers that includes an expanded water supply reliability element in their adopted urban water management plans, agricultural water management plans, and/or IRWM plans.

7.2.5 DWR and the USBR will complete the Bay Delta Conservation Plan (both the Habitat Conservation Plan/Natural Communities Conservation Plan and the Environmental Impact Report/Environmental Impact Statement), a 50-year ecosystem-based plan designed to restore fish and wildlife species in the Delta in a way that protects California's water supplies while minimizing impacts on Delta communities and farms. Upon adoption of the BDCP and receiving the necessary permits by the regulating agencies, DWR and the USBR will implement the 22 proposed conservation measures in the BDCP to help wildlife and reverse the decline of native fish populations in the Delta.

7.2.6 DWR, in coordination with the SWRCB, CDPH, Public Utilities Commission, Energy Commission, USBR, California Urban Water Conservation Council, and other stakeholders, should develop a coordinated statewide system for water use reporting. Water suppliers that export water from, transfer water through, or use water in the Delta watershed should be full participants in the database.

7.2.7 DWR, in consultation with the SWRCB and other agencies and stakeholders, should evaluate and include in the next and all future CWP updates information needed to track water supply

reliability performance measures identified in the Delta Plan, including an assessment of water efficiency and new water supply development, regional water balances, improvements in regional self-reliance, reduced regional reliance on the Delta, and reliability of Delta exports, and an overall assessment of progress in achieving the coequal goals.

- 7.2.8 Immediately provide financial incentives and technical assistance through the IRWM plans and the Local Groundwater Assistance Program to improve surface water and groundwater monitoring and data management.

7.3 Water quality in the Delta should be maintained at a level that supports, enhances, and protects beneficial uses identified in the applicable SWRCB or RWQCB water quality control plans.

- 7.3.1 The SWRCB should update the Bay-Delta Water Quality Control Plan objectives as follows:

- A. By June 2, 2014, adopt and begin to implement updated flow objectives for the Delta that are necessary to achieve the coequal goals.
- B. By June 2, 2018, adopt, and as soon as reasonably possible, implement flow objectives for high-priority tributaries in the Delta watershed that are necessary to achieve the coequal goals.

- 7.3.2 The SWRCB and RWQCBs should work collaboratively with DWR, DFW, and other agencies and entities that monitor water quality in the Delta to develop and implement a Delta Regional Monitoring Program that will be responsible for coordinating monitoring efforts so Delta conditions can be efficiently assessed and reported on a regular basis.

- 7.3.3 DFW and other appropriate agencies should prioritize and implement actions for non-native invasive species from the *Conservation Strategy for Restoration of the Sacramento–San Joaquin Delta Ecological Management Zone and the Sacramento and San Joaquin Valley Regions* (California Department of Fish and Game 2011).

**PLACEHOLDER Table 8-7 Related Actions and Performance Measures for Objective 7
(Manage the Delta to Achieve the Coequal Goals for California)**

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of this chapter.]

Objective 8 — Prepare Prevention, Response, and Recovery Plans

Prepare prevention, response, and recovery plans for floods, droughts, and catastrophic events to help residents and communities, particularly disadvantaged communities, make decisions that reduce the consequences and recovery time of these events when they occur.

An overall purpose of this objective is to prepare prevention response and recovery plans that coordinate the actions by State agencies, local governments, business and industry, and citizens.

The State Multi-Hazard Mitigation Plan (SHMP) is the official statement of California’s statewide hazard mitigation goals, strategies, and priorities. Hazard mitigation can be defined as any action taken to reduce or eliminate long-term risk to life and property by natural and human-caused disasters. The SHMP classifies hazards into a hierarchy of primary impacts (earthquake, flood, wildfire); secondary impacts (vulnerable levees, landslides, tsunamis); climate-related hazards (drought, heat, severe storms); and other (terrorism, hazardous materials release, dam failure).

The hazards of floods and droughts have an obvious nexus to water planning. Other hazards, such as earthquakes and wildfire, have a less obvious nexus, but they can have impacts on and from water. As California grows, it faces the dual challenges of addressing vulnerabilities in the built and natural environment while accommodating growth and change in ways that avoid or mitigate future vulnerabilities.

Of these hazards, drought differs in the timing of the impacts. The impacts of drought are typically felt first by those most reliant on annual rainfall — ranchers engaged in dry land grazing, rural residents relying on wells in low-yield rock formations, or small water systems lacking a reliable source. Drought impacts increase with the length of a drought, as carryover supplies in reservoirs are depleted and water levels in groundwater basins decline. However, unlike earthquakes, fires, or floods, drought onset is slow, allowing time for water suppliers to implement preparedness and response actions to mitigate reductions in normal supplies.

Related Actions

8.1 Communities in floodplains should consider the consequences of flooding and should develop, adopt, practice, and regularly evaluate formal flood emergency preparedness, response, evacuation, and recovery plans (see Objective 6).

8.1.1 State government should assist disadvantaged communities located in floodplains to prepare for and recover from flood emergencies.

8.2 Water shortage contingency plans prepared as part of the 2015 urban water management plans should increase drought planning from a 3-year drought to a 4-year drought, until more accurate information is available.

8.3 By December 2014, DWR will update the California Drought Contingency Plan, which includes:

- A. Articulation of a coordinated strategy for preparing for, responding to, and recovery from drought.
- B. Assessment of state drought contingency planning and preparedness.
- C. Description of State government's role and responsibilities for drought preparedness.
- D. Identification of needed improvements for drought monitoring and preparedness.
- E. Identification of measures to mitigate the economic, environmental, and social risks and consequences of drought events.
- F. Assessment of and adaptation to the impacts of drought under existing and future conditions, including climate change.
- G. Identification of needed improvements to real-time surface water and groundwater monitoring programs.
- H. Identification of needed research in drought forecasting.
- I. Identification of needed research of the indices and metrics for assessing the levels of drought.

8.4 DWR will work with the California Governor's Office of Emergency Services (Cal OES) to develop preparedness plans to respond to other catastrophic events, such as earthquakes, wildfires, chemical spills, facility malfunctions, and intentional disruption, which would disrupt water resources and infrastructure.

8.5 Cal OES, the California Governor's Office of Planning and Research (OPR), and the California Natural Resources Agency should lead an effort to update the State Emergency Plan and State Multi-

Hazard Mitigation Plan to strengthen consideration of climate impacts to hazard assessment planning, implementation priorities, and emergency responses.

8.6 Cal OES, DWR, and the Delta counties should work together to develop a catastrophic flood response plan for the Delta region. This plan should support an integrated response within the Delta and increase communication efforts between stakeholders and federal, State, tribal, local, and private agencies.

8.7 Cal OES will work with appropriate agencies to update the San Francisco Bay Area Catastrophic Earthquake Response Plan and incorporate lessons learned from the 2013 Golden Guardian exercise.

PLACEHOLDER Table 8-8 Related Actions and Performance Measures for Objective 8 (Prepare Prevention, Response, and Recovery Plans)

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of this chapter.]

Objective 9 — Reduce the Carbon Footprint of Water Systems and Water Uses


Reduce the carbon footprint of water and wastewater management systems by implementing the water-related strategies in the AB 32 Scoping Plan to mitigate greenhouse gas emissions.

According to the California Energy Commission, the end use of water is the most energy-intensive portion of the water use cycle in California. Approximately one-fifth of the state’s electricity is used for water conveyance and distribution. In December 2008, the California Air Resources Board (ARB) approved the Proposed AB 32 Scoping Plan, which included six measures for reducing the energy intensity and resulting GHG emissions of water uses and water and wastewater management systems. These six measures were included as related actions in Update 2009.

In early 2013, ARB initiated activities to update the AB 32 Scoping Plan to evaluate the mix of AB 32 policies to ensure that California is on track to achieve the 2020 GHG reduction goal. The AB 32 Scoping Plan update will define ARB’s climate change priorities for the next five years and lay the groundwork to reach post-2020 goals set forth in Executive Orders S-3-05 and B-16-2012. The AB 32 Scoping Plan update will highlight California’s progress toward meeting the “near-term” 2020 GHG emission reduction goals defined in the original Scoping Plan (2008). It will also evaluate how to align the State’s longer-term GHG reduction strategies with other State policy priorities, such as for water, waste, natural resources, clean energy and transportation, and land use.

It is anticipated that the revised measures related to water in the AB 32 Scoping Plan update will be incorporated as related actions under this objective as part of Update 2013. ARB’s timeline for the AB 32 Scoping Plan update is to release a preliminary draft for public review and comment in mid-August 2013, then provide an updated Scoping Plan document to ARB for consideration in November 2013. Additional information is available on the ARB’s Web site at:
<http://www.arb.ca.gov/cc/scopingplan/scopingplan.htm>.

Related Actions

[Note: These related actions are under development and will include actions and recommendations from the updated Water-Energy Team of the Climate Action Team (WETCAT) strategy when available.] 

PLACEHOLDER Table 8-9 Related Actions and Performance Measures for Objective 9 (Reduce Energy Consumption of Water Systems and Uses)

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of this chapter.]

Objective 10 — Improve Data, Analysis, and Decision-Support Tools

Improve and expand data monitoring, management, analysis, and decision-support tools to advance IWM, in light of demographic, climate, and institutional uncertainties.

This objective and its related actions rely heavily on information contained in Chapter 6, “Integrated Data and Analysis.” The related actions were informed by advice from the Statewide Water Analysis Network (SWAN), which serves as the technical advisory group for the CWP. SWAN consists of technical experts from federal, State, and local agencies; universities; non-governmental organizations; consultants; and tribes. Additional sources of information include the Update 2013 featured companion State plans described in Chapter 4, “Strengthening Government Alignment,” particularly the Delta Plan from the Delta Stewardship Council and the recommendations from the Alluvial Fan Task Force. The actions were also informed by the CWP’s State Agency Steering Committee, Public Advisory Committee, and Tribal Advisory Committee, as well as stakeholder input at workshops to discuss the Update 2013 objectives and related actions.

The related actions described here are intended to promote significant improvements in the way water managers develop and share water information by making data more accessible, supporting critical updates in analytical tools, and fostering collaboration around data and tools used to support policy decisions. California needs better data and analytical tools to produce useful and more integrated information to support IWM. Investment in our analytical capabilities lags far behind the growing challenges facing water managers. Significant new investment in our technical capabilities is needed to prepare for the impacts from extended droughts, flood events, and climate change, as well as to improve management of the Delta. Improving communication between technical experts and decision-makers goes hand in hand with improving our technical capabilities because sound technical information is critical to making robust policy decisions.

Related Actions

To develop and use analytical tools more effectively, DWR should take the following actions, in coordination with the SWRCB, CDPH, Public Utilities Commission, Energy Commission, USBR, California Urban Water Conservation Council, California Council for Science and Technology, IRWM Regional Water Management Groups, and other agencies, organizations, tribes, and stakeholders.

- 10.1 Expand the Central Valley Planning Area scale analytical tool and scenario studies developed during Update 2013 to assess future vulnerabilities and management responses in the other hydrologic regions for the California Water Plan Update 2018. The regional analytical tools and analysis should include evaluation of water supply reliability, water efficiency and new water supply development,

regional water balances, improvements in regional self-reliance, reduced regional reliance on the Delta, and reliability of Delta exports. Over time, these tools should be enhanced to include water quality, economic, and biological metrics, as well as to evaluate a greater number of the resource management strategies in Volume 3.


10.2 Develop a shared conceptual understanding, analytical framework, and quantitative description of how California watersheds and water management systems are represented in analytical tools at different spatial and temporal scales for use by federal, State, tribal, regional, and local agencies and organizations.

10.3 Support the California Water and Environmental Modeling Forum (CWEMF) in updating its 2000 modeling protocols and standards to provide more current guidance to water stakeholders and decision-makers, and their technical staff, as models are developed and used to solve California's water and environmental problems.

To improve water data and information, DWR should take the following actions, in coordination with the SWRCB, CDPH, Public Utilities Commission, Energy Commission, USBR, California Urban Water Conservation Council, California Council for Science and Technology, IRWM Regional Water Management Groups, and other agencies, organizations, tribes, and stakeholders.

10.4 Establish standards and protocols for data collection and management that facilitate sharing of information among agencies and modeling studies. This would include identifying and cataloging existing water data for California, creating a water data dictionary, and developing standards and metadata for water data monitoring, collection, and reporting.

10.5 Develop a strategic plan for data management that prioritizes long-term improvements in the monitoring network considering risk-based decision-making, and that identifies adequate resources for long-term maintenance and accessibility to water management information.

10.6 Improve drought planning and preparation by: 

10.6.1 Developing drought metrics (indicators) with the goal of providing early detection and determination of drought severity.

10.6.2 Developing and improving monitoring of key indicators of regional water vulnerabilities.

10.6.3 Improving the system of stream gauging for the purpose of managing water resources in low-flow conditions and improving the accuracy of seasonal runoff and water supply forecasts.

10.6.4 Improving groundwater monitoring and assessment by providing technical and financial support to develop real-time monitoring of groundwater data.

10.6.5 Expanding the existing surface water and groundwater monitoring networks, where needed.

10.7 Develop a strategy and implementation plan for measuring and reporting water use and water quality data. The accurate measurement, timely publication, and broad distribution of water use and water quality will facilitate better water planning and management, especially in the context of managing aquifers more sustainably, and are necessary for the development of more accurate hydrologic budgets.

10.8 Sponsor science-based, watershed adaptation research and pilot projects to address water management and ecosystem needs, improve aquatic species and habitat monitoring, and develop an accessible and standardized database for reporting watershed and headwater conditions.

To improve data and information exchange, DWR should take the following actions, in coordination with the SWRCB, CDPH, Public Utilities Commission, Energy Commission, USBR, California Urban Water Conservation Council, California Council for Science and Technology, IRWM Regional Water Management Groups, and other agencies, organizations, tribes, and stakeholders.

10.9 Develop the Water Planning Information Exchange (Water PIE) to facilitate sharing data and networking existing databases among federal, State, tribal, regional, and local agencies and governments; nonprofit organizations; and citizen monitoring efforts. The Water PIE data framework will help improve analytical capabilities and develop timely surveys of statewide land use, water use, and estimates of future implementation of resource management strategies. Potential beneficiaries of Water PIE include urban water management plans, agricultural water management plans, groundwater management plans, IRWM plans, and the CWP.

10.10 Support establishment of an open, organized, and documented quantitative representation of the State's intertidal water system to serve as a common and standardized data platform for model development and analysis by federal, State, tribal, regional, and local water planners.

10.11 Implement Shared Vision Planning or similar collaborative modeling approaches to integrate tried-and-true planning principles, systems modeling, and collaboration into a practical forum for making more informed and durable water resources management decisions.

PLACEHOLDER Table 8-10 Related Actions and Performance Measures for Objective 10 (Improve Data, Analysis, and Decision-Support Tools)

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of this chapter.]

Objective 11 — Invest in Water Technology and Science

Identify, develop, and prioritize research needs for new technologies; advance development and implementation of existing and emerging tools, technologies and innovations; and encourage partnerships in water-related technology and science to promote more efficient, effective, and sustainable water resources management and a better scientific understanding of California's water-related systems.

Federal, State, tribal, regional, and local governments; non-governmental organizations; California research and academic institutions; and private applied research and innovation initiatives should work together to identify, prioritize, and fund applied research projects. Specifically, research projects would involve the commercialization of new water technologies and advancement of cost and energy-efficient emerging tools and technologies. Such collaboration among the abovementioned organizations and entities will also encourage fuller implementation of existing, effective technologies — in support of more integrated, aligned, and sustainable water management.

The objective and related actions come out of an effort of the CWP Water Technology Caucus and the California Council for Science and Technology (CCST). The CWP Water Technology Caucus is a statewide topic-based workgroup designed to support development of Update 2013 through in-depth discussions and deliberations of innovation, applied research and development, and technology. The Water Technology Caucus helped identify and expand information associated with statewide and regional opportunities and challenges for implementing new water technologies in California. The statewide and regional information helps inform technology planning efforts, pilot projects, and investments by federal, State, tribal, regional, and local governments; non-governmental organizations; and private applied research and innovation initiatives. This collaborative process can lead to the commercialization of new water technologies; an enhanced focus on California water research, information, and data needs (see also Objective 10 — Improve Data, Analysis, and Decision-Support Tools); and a better scientific understanding of California's water-related systems. The Water Technology Caucus works closely with California research and academic institutions working on water technology initiatives to develop the water technology-related actions for Update 2013.

Innovations in science and technology have long been recognized as a key driving force of economic growth, especially in high-technology economies such as California's. However, State government has limited resources and is seeking ways to most effectively encourage and sustain an environment where innovation can flourish. In early 2012, the CCST initiated the California's Water Future Project to identify and describe technology innovation and/or systems approaches currently under development or available for application. These innovations can be used in California, on a statewide, regional, local, or project basis, for immediate adoption and within the next five to 10 years to enhance California's IWM; efficient water use; effective groundwater management; and environmental restoration and sustainable management, including optimization of river systems for state-determined goals. The project goals were to make specific recommendations regarding:

- Technologies that appear to have the most promise for California over the next 5-10 years.
- Policy and process changes needed to commercialize and more broadly deploy identified innovation.

The target audience for the California's Water Future Project is anyone in the science and technology community with an interest in water; DWR; and federal, State, and local policy-makers. Additional information on CCST's Water Future Project is available in Volume 4, *Reference Guide*.

State government will continue to work with California research and academic institutions — such as the California Academy of Sciences, California Council on Science and Technology, the University of California, California State University, and other universities and colleges — to identify and prioritize applied research projects leading to the commercialization of new water technologies and better scientific understanding of California's water-related systems.

Related Actions

11.1 Advance new water technology to improve Data Management and Modeling by implementing the following:

- 11.1.1 Development and implementation of a standardized protocol for water use and quality measurement and reporting strategy and implementation plan necessary for sustainable California water planning and management.

- 11.1.2 Development and compliance of protocol for distributed data storage and use policy with all database managers and with all data linked to the appropriate metadata.
- 11.1.3 Development of effective interactive database portals, such as Water PIE (DWR) and HOBBS (UC Davis), should continue with a high priority.
- 11.1.4 Support for the maintenance of current modeling protocols and standards that provide guidance to water stakeholders and decision-makers, and their technical staff, as models are developed and used to solve California's water and environmental problems. The California Water and Modeling Forum should continue to have a major role in this important effort.

11.2 Advance new water technology to improve both in situ (on-site) and remote sensing for data acquisition by implementing the following:

- 11.2.1 Developing closer coordination between in situ sensing and remote sensing.
- 11.2.2 Supporting technology fairs and/or other effective venues for presenting licensing opportunities for technology developed by the National Laboratories and other government agencies with technology development focused on the water environment.
- 11.2.3 Increasing the deployment of land based radar where local topographic features prevent adequate weather forecasting.

In situ (on-site) Data Acquisition: Priorities for in situ data acquisition technology research include:

- 11.2.4 Development is required of protocol for data acquisition and compatibility of associated equipment.
- 11.2.5 Development of cost effective sensors.

Remote Sensing Data Acquisition: Priorities for remote-sensing data acquisition technology research include:

- 11.2.6 Development and use of remote sensors capable of accurately determining qualitatively quantitatively more chemical and physical parameters for fresh water bodies.
- 11.2.7 Development of inexpensive, local remote sensors to replace or complement in situ sensors for the purpose of providing monitoring capability that is less susceptible to vandalism.
- 11.2.8 Continue the development of utilizing airborne drones to provide targeted data to complement satellite data (e.g., snowpack, reservoir level).
- 11.2.9 Increased partnerships between the National Aeronautics and Space Administration (NASA), state and private sectors to enhance existing resources while realizing savings by reducing duplicative monitoring and/or increasing required data acquisition opportunities.

11.3 Advance new water technology to improve efficiencies for the Water-Energy Nexus by implementing the following:

- 11.3.1 Smart grid technologies for water and energy conservation and management.
- 11.3.2 Use of renewable energy for water treatment and transport processes.
- 11.3.3 Developing anaerobic processes to facilitate energy recovery from supply and wastewater organic residuals.
- 11.3.4 Improve technology for residential use of point-of-use (POU) and point-of-entry (POE) treatment.

11.4 Advance new water technology to improve Membrane Water Treatment by implementing the following:



11.4.1 Further development of more robust, cost- and energy-efficient, general-purpose membranes for use in seawater desalination, brackish water treatment, and wastewater and water reuse applications, with removal of contaminants not now efficiently removed (e.g., boron, contaminants of emerging concern), and recovery of beneficial salts and minerals for reuse.

11.4.2 Further development of energy recovery technologies, particularly for high-pressure reverse osmosis units (e.g., operational pressure as high as 1,180 pounds per square inch gauge [psig], or 8 megapascals [MPa]) but also with application to separation technologies operating at lower pressures.

11.4.3 Further development of smart control technology that ensures more dependable operation of treatment facilities, including remotely located treatment facilities (distributed treatment).

11.4.4 Development of membrane separation technologies capable of reliable and economic deployment to remotely located communities (distributed treatment).

11.4.5 Significantly broadened deployment of brine disposal technologies for disposal into marine environments already used outside of California.

11.5 Advance new water technology to improve Biological Water Treatment by implementing the following:

11.5.1 Development and deployment of technologies focused on wastewater cleanup for recycling process and wastewater, including use as drinking water (i.e., drinking water, irrigation, process water, groundwater recharge).

11.5.2 Development of technologies to reduce chemical use and increase energy efficiency, such as engineered wetlands for wastewater treatment and ecosystem enhancement.


11.5.3 Technology development to support the increased use of affordable distributed biological water and wastewater treatment systems for small, rural communities.

11.5.4 Development of better control technology for biological treatment, similar to the earlier stated research priority for membrane separation technology.

11.6 Advance new water technology to improve watershed management by implementing the following:

11.6.1 Software development that leads to more effective combining and utilizing of applicable models, in recognition of the need for the effective management of the multiple factors affecting watersheds, including climate change impacts.


11.6.2 Improved data collection for surface-water and groundwater basin descriptive parameters, including water runoff and storage as a function of time throughout the basin by more extensive use of satellite monitoring, where applicable, and partnering with other agencies (i.e., DWR, SWRCB, U.S. Geological Survey, and others) where possible.

11.6.3 Expanded use of flood plains and other sites having good recharge potential for groundwater recharge. 

11.7 Advance new water technology to improve Agricultural Water Use Efficiency by implementing the following:

11.7.1 Increase the adoption of field level water measurement (flow and total) and soil moisture-sensing technologies to increase water management accuracy and data.

11.7.2 Promote the use of high-efficiency water irrigation systems, provide necessary maintenance, and utilize proper irrigation scheduling methods to optimize water- and energy-use efficiency.

- 11.7.3 Increased adoption of one or more technologies for irrigation scheduling (e.g., including remote sensing, weather based, and/or crop/soil-based technologies). 
- 11.7.4 Development of cost-effective irrigation system performance information monitoring platforms for evaluating irrigation performance criteria in real time.
- 11.7.5 Increase the number of water districts that provide water deliveries on a demand basis to maximize on-farm water use efficiency.
- 11.7.6 Use agricultural water and land whenever appropriate to provide local environmental benefits (e.g., flooded rice ground to provide seasonal wetlands for migratory birds and reproduction habitat for fish and aquatic life).
- 11.7.7 Identification of shared-use opportunities for water supplies (e.g., water exchanges between agricultural and urban users).

11.8 Advance new water technology to improve Urban Water Use Efficiency by implementing the following:

- 11.8.1 Metering infrastructure to promote more efficient water use (e.g., individual apartments, remote access to water use data).
- 11.8.2 Continued advancement of plumbing code and efficiency standards for low-flow appliances and fixtures, such as toilets and clothes and dish washers in the home and low-flow cleaning technologies in the commercial and industrial sectors.
- 11.8.3 Increased use of American Water Works Association water-loss software and verification program.
- 11.8.4 Greater use of low-water-use landscaping.

PLACEHOLDER Table 8-11 Related Actions and Performance Measures for Objective 11 (Invest in Water Technology and Science)

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of this chapter.]

Objective 12 — Improve Tribal/State Relations and Natural Resources Management

Develop relationships with California Native American Tribes that acknowledges and respects their inherent rights to exercise sovereign authority and ensure that they are incorporated into planning and water resources decision-making processes in a manner that is consistent with their sovereign status.

Update 2005 recommended that DWR and other State agencies invite, encourage, and assist the participation of tribal government representatives in statewide, regional, and local water-planning processes and to access State funding for water projects. As part of Update 2009, the Tribal Communication Committee prepared the comprehensive *Tribal Communication Plan* (Tribal Communication Committee 2008) for the CWP (as presented in Update 2009, Volume 4, *Reference Guide*). The 10 *Tribal Communication Plan* objectives were included in the Update 2009 related actions. (Refer to the *Tribal Communication Plan* for a definition of California Native American Tribes.)

For Update 2013, a Tribal Advisory Committee was convened, and a Tribal Water Summit for the update was held in April 2013. The summit included the development of the *Guiding Principles and Statement of Goals for Implementation*. This objective incorporates the related actions from Update 2009, the 2013

Tribal Water Summit *Guiding Principles and Statement of Goals for Implementation*, and the 2013 Tribal Water Summit implementation objectives.

Related Actions

12.1 The State, in collaboration with California Native American Tribes, should, where it is within the State's authority, address tribal water rights, including tribal water rights dating back to time immemorial; federally reserved water rights; jurisdiction; and trust responsibilities, including individual allotments, by:

12.1.1 Convening a task force to articulate a consistent State policy and protocol that recognizes tribal water rights in all aspects of water planning, including supply, timing, flows, quality, and quantity.

12.1.2 Bureau of Indian Affairs and SWRCB, in collaboration with California Native American Tribes, developing joint training on State, federal, and tribal water rights, including trust responsibilities, the implications for different tribal trust lands (reservations, rancherias, and individual allotments) and jurisdiction.

12.2 State government should write legislation and contracts in a way that enables California Native American Tribes to be a lead agency and directly receive and manage state funding (as fiscal agent or otherwise) for water planning and management.

12.3 DFW and California Native American Tribes will develop and initiate pilot projects to develop resource management plans, characterized by the integration of Traditional/Tribal Ecological Knowledge and western science. This will include identifying existing examples of partnerships and launching pilot projects.

12.4 State agencies should use Tribal Ecological Knowledge to inform their work and decisions, including establishing baseline resource conditions and developing options to share information in ways that protect specific details about cultural resources.

12.5 State agencies, in collaboration with California Native American Tribes, should develop and conduct trainings for agencies on tribal sovereignty, trust responsibilities, cultural awareness/sensitivity, and Traditional/Tribal Ecological Knowledge by developing a curriculum with a tribal working group, establishing consistent training protocols for all agencies, and initiating trainings.

12.6 State and federal agencies, in coordination with California Native American Tribes, should identify, coordinate, and provide technical training for California Native American Tribes, to increase technical capacity — including, but not limited to, basic training modules (e.g., Basic Inspector Academy, GIS, small water systems operations, such advanced technologies as LiDAR and satellite imagery) — and establish criteria and protocols for ensuring training vendors preferred by California Native American Tribes are utilized.

12.7 State agencies should engage tribal communities in compiling and developing climate change adaptation and resilience strategies that will mitigate climate impacts to their people, waterways, cultural resources, or lands.

12.8 The SWRCB should, in collaboration with California Native American Tribes, propose a statewide beneficial use definition that respects and acknowledges cultural and subsistence use of water and this definition should be adopted in statewide water quality control plans.

12.9 State agencies and California Native American Tribes should utilize and implement communication strategies, protocols, and procedures that are developed and/or implemented by California Native American Tribes, including but not limited to the Tribal Communication Plan, U.N. Declaration on the Rights of Indigenous Peoples, 2013 Tribal Water Summit Guiding Principles and Goals, and tribal memoranda of understanding.

12.10 State agencies, in collaboration with California Native American Tribes, should enhance tribal outreach, communication, coordination, collaboration, and the work of tribal liaisons by identifying and implementing strategies to strengthen tribal involvement in State outreach and engagement approaches; clarify tribal liaison roles and responsibilities; and identify options for creating a statewide network of tribal liaisons to address multiple aspects of tribal concerns (e.g., legal, policy, and local conditions).

12.11 State agencies should engage in meaningful consultation by encouraging and moving toward earlier involvement by California Native American Tribes (at the design/planning stages); initiating consultation for programmatic decisions as well as project-level decisions; understanding individual California Native American Tribes' protocol for consultation, adjusting timelines to allow adequate time to bring items before tribal councils and leaders; conducting meetings on tribal lands; and documenting tribal comments.

PLACEHOLDER Table 8-12 Related Actions and Performance Measures for Objective 12 (Improve Tribal/State Relations and Natural Resources Management)

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of this chapter.]

Objective 13 — Ensure Equitable Distribution of Benefits

Increase the voice of small and disadvantaged communities in State processes and programs to achieve fair and equitable distribution of benefits. Provide access to safe drinking water and wastewater treatment for all California communities and ensure programs and policies address the most critical public health threats in disadvantaged communities.

Update 2005 recommended that DWR and other State government departments and agencies should invite, encourage, and assist representatives from disadvantaged communities and vulnerable populations, and the local agencies and private utilities serving them, to participate in statewide, regional, and local water planning processes and to get equal access to State funding for water projects. State policy establishes social equity and environmental justice (EJ) as State planning priorities to ensure the fair treatment of people of all races, cultures, and income, in particular those having experienced significant disproportionate adverse health and environmental impacts.

To enforce the fair treatment clause, four key requirements must be met:

- Disadvantaged and disproportionately affected communities must be identified and engaged.

- The water-related needs of these communities must be identified, and potential solutions developed and funded.
- The impact of water management decisions on these communities must be considered and mitigated.
- All State programs must be evaluated to document progress.

A number of efforts to better address EJ and economically disadvantaged community concerns have advanced since Update 2005.

In 2008, the California Public Resources Code, Section 75005(g), was added to define a “disadvantaged community” (DAC) as a community with a median household income of less than 80 percent of the statewide average. A “severely disadvantaged community” is one with a median household income of less than 60 percent of the statewide average.

The current DWR guidelines for IRWM funding, allocated through voter-approved Propositions 84 and 1E, identify statewide priorities among which is a goal to “ensure equitable distribution of benefits.” For implementation grants, DWR has prioritized proposals that:

- Increase the participation of small communities and DACs in the IRWM process.
- Develop multi-benefit projects with consideration given to affected DACs and vulnerable populations.
- Address safe drinking water and wastewater treatment needs of DACs.

In 2012, California Water Code Section 106.3 was added to declare that the established policy of the State recognizes every human being as having the right to safe, clean, affordable, and accessible water adequate for human consumption, cooking, and sanitary purposes. All relevant State agencies, including DWR, SWRCB, and CDPH, are required to consider this State policy when revising, adopting, or establishing policies, regulations, and grant criteria when those policies, regulations, and criteria are pertinent to the uses of water described in this section.

Other initiatives have also moved forward, including:

- Final Report To The Governor’s Office August 20, 2012, Governor’s Drinking Water Stakeholder Group, Agreements and Legislative Recommendations.
- CDPH’s Small Water System Program Plan.
- SWRCB’s Small Community Wastewater Grant Program.

Even with all these efforts, one of the challenges that State agencies and water systems express about trying to address the needs of DACs is simply answering these two questions: “Who are they?” and “Where are they?”

The CWP can provide guidance and tools for identifying disadvantaged and EJ communities. It is vitally important to identify community needs. Most water, wastewater, and flood projects are not developed for these communities; and yet, they can affect them. It is important to understand that even projects that convey “general” public benefit may not proportionally benefit EJ communities or DACs. For example, conservation programs that depend heavily on toilet and washing machine rebates will have greater penetration in middle- and upper-class communities than they will in poorer communities that purchase

less frequently and cannot afford the initial outlay for the fixture. These problems are resolved by taking community concerns into account during the project design phase to ensure equitable benefits.

Another concept that plays into the measurement of impacts is the cumulative effects of a project. It is understandable that water agencies would look at other water projects in determining the impact of their project, but that practice ignores the reality of these communities. That is, these communities endure so many challenges on a daily basis, that one more, from any source, only adds to what may already be an excessive burden.

Finally, planners should develop multi-benefit projects with consideration given to affected DACs and vulnerable populations. This is particularly true in already affected communities. For example, if an agency is developing a flood management project, it would be prudent to look at developing the project in ways that will provide flood protection, as well as open space, wildlife habitat, and/or recreational opportunities, to DACs and vulnerable populations.

Related Actions

13.1 Ensure implementation of the policy goals of California Water Code Section 106.3 (AB 685), which state that every human being has the right to safe, clean, affordable, and accessible water adequate for human consumption, cooking, and sanitary purposes.

13.1.1 State government should ensure that the goals established by the policy — safe, clean, affordable, and accessible water adequate for domestic uses — are reflected in agency planning.

13.1.2 State government should give preference to policies that advance the policy and refrain from taking actions that adversely affect the human right to water.

13.1.3 State government should report on actions undertaken to promote the policy and make information relevant to the human right to water available to the public.

13.1.4 State government should foster meaningful opportunities for public participation in agency decision-making by California's diverse population.

13.1.5 State government should facilitate access by rural and urban DACs to state funds for water infrastructure improvements.


13.1.6 State government should ensure the effectiveness of accountability mechanisms protecting access to clean and affordable water.

13.2 Increase EJ and DAC participation in planning.

13.2.1 DWR and the other CWP Steering Committee members should incorporate EJ issues of precautionary applications, cumulative health impact reductions, public participation, community capacity building and communication, and meaningful participation in current and future CWP Update processes and other programs.

13.2.2 DWR should require that grant and loan recipients conduct outreach to DACs and vulnerable populations and their advocates to seek their participation in water planning programs, including the CWP update, and IRWM plans and other local water planning processes.

13.3 Develop CWP goals and objectives, in coordination with IRWM partnerships, to resolve water-related public health issues in DACs.

- 13.3.1 California tribes, both recognized and unrecognized, should provide goals and objectives to protect tribal uses of water, especially those that affect the health of tribal members (see Objective 12).
- 13.3.2 DWR, DFW, and other State agencies should develop statewide goals and objectives for the provision of safe fish for communities that rely on fish as part of their subsistence diet.
- 13.3.3 DWR, in consultation with other State agencies, including the Department of Conservation, tribes, and community groups, should develop goals and objectives to restore and protect watersheds by making use of existing community-based watershed councils and groups under-utilized in maintaining and restoring California’s water resources.
- 13.4 Support financial mechanisms to facilitate improved wastewater removal systems. 
- 13.4.1 The SWRCB and DWR should establish incentives to support conversion to municipal or other upgraded wastewater removal systems.
- 13.4.2 The SWRCB and DWR should establish a process to create introductory, then graduated, wastewater rates to allow a period of adjustment for new fees.
- 13.5 Increase disadvantaged community access to funding.
- 13.5.1 The SWRCB, CDPH, DWR, and other State agencies should work with DACs and vulnerable populations and their advocates to review State government funding programs and develop guidelines that make funding programs equally accessible to DACs and EJ communities.
- 13.5.2 The SWRCB, CDPH, DWR, and other State agencies should work with DACs and vulnerable populations and their advocates to develop a technical assistance program to provide resources, expertise, and information to DACs and EJ communities to enable them to actively and equally participate in planning processes and access funding sources.
- 13.6 Provide incentives for the consolidation, acquisition, or improved management of small water systems.
- 13.6.1 CDPH should establish incentives to encourage consolidation with the “smalls” by the larger system. There are valid concerns on the part of the larger system when approached with the idea of acquiring small, dysfunctional systems.
- 13.6.2 CDPH should conduct outreach and education for customers and shareholders to a proposed consolidation to ensure informed decision-making.
- 13.6.3 CDPH should support efforts to improve licensing and training options for small water system operators.
- 13.7 CDPH should implement its Small Water System Program Plan to assist small water systems (especially those serving DACs) that are unable to provide water that meets primary drinking water standards.
- 13.7.1 CDPH should share the Small Water System Program Plan with relevant federal, State, and local agencies, as well as stakeholders, to foster additional opportunities for funding, coordinate construction projects in communities, and assist in local and regional planning efforts.
- 13.7.2 CDPH should utilize GIS tools to identify large water systems in close proximity to targeted small water systems, and conduct targeted outreach to these large water systems to encourage them to consolidate the small systems into their service area.

- 13.7.3 CDPH should work with stakeholders to identify obstacles to consolidation (including financial, legal, and local issues) and develop possible actions to address these obstacles.
- 13.7.4 CDPH should participate in statewide planning efforts to address the water infrastructure needs of small water systems. CDPH should seek input from other states and the federal government on innovative, successful efforts to address the needs of small water systems, and should share its results on implementation of its Small Water System Program Plan.

13.8 Collect and maintain data on EJ communities and DACs.

- 13.8.1 The SWRCB, CDPH, DWR, and other State and federal agencies should coordinate their review of current monitoring and regulatory programs to identify and address gaps in available data and monitoring programs that affect DACs and vulnerable populations.

PLACEHOLDER Table 8-13 Related Actions and Performance Measures for Objective 13 (Ensure Equitable Distribution of Benefits)

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of this chapter.]

Objective 14 — Protect and Enhance Public Access to the State’s Waterways, Lakes, and Beaches

Protect and enhance public access to the state’s waterways, lakes, and beaches for cultural, recreational, and economic purposes consistent with maintaining healthy ecosystems.

Public access to our natural waterways, lakes, and beaches has been embedded in the California’s Constitution since the founding of the state. Activities such as boating, fishing, exploring the beach, and swimming are an important part of our heritage, our culture, our identity, and our economy. California’s Legislature has repeatedly acknowledged the importance of developing the state’s water resources to provide more public access and more recreational opportunities through our water supply, watershed protection, and flood management projects. The rich variety of recreation opportunities created by the state’s natural, managed, and constructed water bodies supports public health and welfare, sustains healthy businesses and communities, and promotes wise use of our abundant natural resources. Critical to maintaining California’s heritage is the need to protect and enhance public access to the state’s waterways, lakes, and beaches for the foreseeable future. Doing so will require the development and implementation of related actions that guide decision-makers tasked with managing the state’s waterways, lakes, and beaches.

The related actions below are a compilation of guidance from strategic planning documents for agencies as diverse as California State Parks, the Sierra Nevada Conservancy, and the Delta Stewardship Council. This is a new objective for the CWP, so it is expected that the related actions and performance measures will be more comprehensive as more agencies with public access responsibilities participate in the next CWP update. More information on this subject is available in Volume 3, Chapter 31, “Water-Dependent Recreation.”

Related Actions

- 14.1 Respect and Protect. State government will respect and vigorously protect waterways, lakes, and beaches for beneficial public use.

- 14.1.1 The State will support the regulatory responsibilities of the California Coastal Commission (beach access), Bay Conservation and Development Commission (San Francisco estuary access), SWRCB (water quality and supply), State Lands Commission (navigation), DFW (inland fisheries), and others that protect beneficial uses such as fishing, boating, and other public access rights.
 - 14.1.2 State conservancies — such as the Sacramento-San Joaquin Delta Conservancy, Tahoe Conservancy, and Sierra Nevada Conservancy — should acquire and/or protect sensitive landscapes, such as key watershed lands and wetlands, flood conveyance zones, riparian woodlands, and vernal pools with important natural resource and scenic values, and significant beneficial public uses. The conservancies, including the State Coastal Conservancy, should protect and/or acquire land to maintain public access to waterways, lakes, and beaches.
 - 14.1.3 The State should protect recreational resource values threatened by the effects of climate change by using strategies of reinforcement, adaption, and/or retreat as feasible.
 - 14.1.4 As water resources are developed, flood control facilities are envisioned, and sea level rise is accommodated, State government, including, but not limited to, DWR and the California Department of Transportation, will protect and minimize impacts on cultural and recreational uses.
- 14.2 Research and Planning. State government should engage in statewide research and planning to meet California’s unmet and growing demand for safe public access to waterways, lakes, and beaches.
- 14.2.1 State government, such as the California Department of Parks and Recreation (California State Parks) and DWR, should document and regularly report on the water-dependent recreational trends of California’s growing population, the public health and economic benefits of recreational activities, and threats to the tourism and lifestyle benefits of California’s water-dependent recreational infrastructure.
 - 14.2.2 State government, such as DWR, will report on the feasibility of incorporating public access facilities into each water resources development and flood management infrastructure project, watershed protection efforts, and environmental restoration projects funded by the State and federal governments. Consider multi-benefit projects that increase waterfront accessibility, create more inclusive access opportunities, support commercial and recreational fishing, encourage economic revitalization, promote excellence and innovation in urban design, enhance cultural and historic resources, and are resilient to a changing climate. Plan to include, where feasible, levee crown widening in levee improvement projects to accommodate multi-purpose recreational trails and bike lanes.
 - 14.2.3 State conservancies, such as the State Coastal Conservancy, Bay Conservation and Development Commission, and California State Parks should collaborate with local agencies to systematically plan to reinforce, adapt, and/or relocate recreational opportunities threatened by sea level rise and transportation or wastewater infrastructure adaptations.
 - 14.2.4 California State Parks should lead comprehensive recreation resource planning of the state’s inland waterways, engaging the public, recreation providers, policy-makers, advocacy groups, and public officials. Consider facilities that provide opportunities for the top outdoor recreation activities identified in the *Survey of Public Opinions and Attitudes on Outdoor Recreation in California*, especially those benefiting disadvantaged communities.

- 14.3 Enhance. All State agencies with public access responsibilities should, in concert with local agencies, enhance safe public access by providing water-dependent recreational facilities and programs that support beneficial uses, and/or improve the social and economic sustainability of federally funded and State- funded infrastructure, watershed protection, and environmental restoration projects.
- 14.3.1 State government, including DWR, California State Parks, and all state conservancies, should facilitate and/or construct water-dependent recreation projects that spur the economic development of disadvantaged communities, provide environmental stewardship benefits, enhance natural resource values, protect or relocate existing recreational opportunities, and meet the regional demand for healthy outdoor recreation opportunities for all Californians, especially children.
- 14.3.2 The Delta Protection Commission and Sacramento-San Joaquin Delta Conservancy should encourage partnerships between other State and local agencies, local landowners, and business people to expand water-dependent recreation and tourism in the Delta and Suisun Marsh, while minimizing adverse impacts on non-recreational landowners. Use California State Parks' *Recreation Proposal for the Sacramento-San Joaquin Delta and Suisun Marsh* and the Delta Protection Commission's *Economic Sustainability Plan* as guides.
- 14.3.3 As California's population increases, State government, such as DWR, DFW, and California State Parks, should increase water-dependent recreation opportunities on existing public land, where feasible. State government should also pursue acquisition opportunities that provide open space and public access to water features, such as the ocean, lakes, rivers, streams, and creeks, where demand exceeds supply.
- 14.3.4 State agencies should prioritize construction of water-dependent recreation facilities identified in IRWM plans; active-use facilities, such as multi-use trails for equestrians, hikers, walkers, and bikers, which improve public health; boating trails; facilities that mitigate or adapt to climate change; facilities that increase the safety of anglers, swimmers, and boaters; and facilities that provide environmental education, such as water conservation and water quality information.
- 14.4 Promote. All State agencies with waterfront public access responsibilities should cooperate with local agencies, businesses, and the general public to promote healthy outdoor recreation, resource-based tourism, and environmental stewardship to benefit public health and welfare, improve the environment, and grow the economy commensurate with protection of public property rights.
- 14.4.1 All state conservancies, DWR, DFW, and California State Parks should improve outreach and education to children and in disadvantaged communities that will improve public health, support California's outdoor lifestyle, and promote wise use of water resources.

**PLACEHOLDER Table 8-14 Related Actions and Performance Measures for Objective 14
(Protect and Enhance Public Access to the State's Waterways, Lakes, and Beaches)**

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of this chapter.]

Objective 15 — Strengthen Alignment of Land Use Planning and Integrated Water Management

Strengthen the alignment of goals, policies, and programs for improving local land-use planning and IWM.

The way in which we use land has a direct relationship to water supply, water quality, flood management and hazard mitigation, and other water topics. For example, compact urban development patterns in urban areas can reduce water demand, improve water quality, limit the amount of development in floodplains, reduce costs for water-related infrastructure, and reduce GHGs. Also, directing development away from agricultural lands allows for multi-objective management of those lands, which includes agricultural preservation, floodplain management, water quality improvement, and habitat conservation.

Cities and counties have primary responsibility for land use planning and regulation in California. Land use planners consider water throughout the local land-use planning process, and water is a critical element in adopting sustainable land-use planning policies. Stronger collaboration between land use planners and water planners can promote more sustainable land-use patterns and greater integration of IWM into local land-use plans. It can also lead to IRWM plans that more accurately reflect and support local government land use and growth policies.

State government has an important role to play in strengthening the alignment of land use and IWM. Existing programs include SB 610 and SB 221 of 2001, which establish processes for coordinating land use and water supply planning. Also, State flood legislation enacted in 2007 requires local general plans to include specific policies to reduce flood risk. Established in 2008, the Strategic Growth Council awards grants for sustainable communities planning, which can integrate IWM at both the regional and local levels.

By enhancing its role, State government can facilitate stronger collaboration between land use planners and water planners. It can provide additional regulatory and financial incentives for local and regional plans that integrate IWM through encouraging compact, sustainable development patterns. Finally, State government can provide technical tools and data resources to make it easier for local governments to prepare land use plans that integrate IWM.

Related Actions

15.1 State Government should provide additional regulatory and financial incentives to developers and local governments to plan and build using compact and sustainable development patterns.

15.1.1 Regulatory incentives include further streamlining of CEQA review for infill projects and further reductions in brownfields liability for innocent purchasers.

15.1.2 Financial incentives include developing criteria for state grant and funding programs that incentivize compact and sustainable development.

15.2 The OPR should provide guidance and financial incentives for integration of IWM issues in general plan updates and Sustainable Communities Strategy (SCS), including both substantive and planning process guidance.



15.3 **Local governments** should integrate relevant IWM issues into their general plan updates. IWM issues relevant to land use planning include water supply, water quality, flood risk management, and climate policies (mitigation and adaptation).

15.4 The Strategic Growth Council should provide guidance and financial incentives for regional planning agency integration of relevant IWM issues into SCSs, transportation blueprint plans, and other regional plans.

15.5 Regional planning agencies should integrate IWM issues into their SCSs, transportation blueprint plans, and other regional plans.

15.6 Local governments should ensure that urban water management plans inform and reflect IRWM plan preparation and implementation, to further IWM integration in local land-use planning that promotes compact and sustainable development.

15.7 Local governments should implement specific land-use planning and regulatory measures to reduce flood risks, consistent with IWM principles and BMPs for land use planning.

15.7.1 Measures include preservation of existing floodplains, aquifer recharge areas, and alluvial fans; restoration of natural floodplain functions; and design measures to increase post-flood resiliency. See Objective 6, Related Action 6.8 regarding the process for developing land use planning BMPs.

15.8 DWR should assist local governments and developers with implementing the *Integrating Water and Land Management: A Suburban Case Study and User-Friendly, Locally Adaptable Tool*, which calculates life-cycle water infrastructure costs for different development patterns.

15.9 State government should evaluate the effectiveness of the 2007 flood management legislation in achieving coordination of land use planning, flood planning, and natural resources. State government should recommend changes to existing laws and their implementation to increase their effectiveness as appropriate.

15.10 State government should evaluate the effectiveness of SB 610 and SB 221 in achieving coordination of land use and water supply planning. State government should and recommend changes to existing laws and their implementation to increase their effectiveness in achieving objectives, as appropriate.

15.11 State government should invest in innovation and technology for assessment of land use, water supply, and flood conditions to further integrate water management and land use.

15.11.1 The State should provide funding, technical information, and BMPs, and publicize accurate and relevant water resources information for use by local governments and developers. The State could serve as an information clearinghouse for regional water supply, water quality, flood management, and climate change vulnerability information that local governments can use in preparing general plans and evaluating development applications.

PLACEHOLDER Table 8-15 Related Actions and Performance Measures for Objective 15 (Strengthen Alignment of Land Use Planning and Integrated Water Management)

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of this chapter.]

Objective 16 — Strengthen Alignment of Government Processes and Tools

Improve, align, and transform processes and administrative tools (incentives and oversight) — at all levels of government — used for water planning, public engagement, program/project implementation, and policy- and regulation-setting to advance IWM.

As water managers move to IWM, regulatory and other requirements designed to achieve actions with a single management objective can appear to work at cross purposes. Multi-benefit projects may require complex considerations that balance needs and trade-offs. In addition, IWM project implementers often report that they must navigate what seems to be a labyrinth of laws, regulations, and permits that

sometimes leads to project delays and mounting planning and compliance costs. These impediments can ultimately create significant difficulties in meeting public safety, environmental stewardship, or economic goals. This objective seeks to establish an approach to assist in aligning activities, honor regulatory goals, and facilitate successful implementation of projects.

The need for improved government alignment is being recognized at all levels of government and in multiple planning processes. For example, the Strategic Growth Council, California Water Commission, Resource Conservation Districts, Water Plan State Agency Steering Committee, California Biodiversity Council, and IRWM Regional Water Management Groups all have stated that the following issues impede broader and better implementation of IWM projects:

- Uncoordinated and fragmented water governance and responsibilities among numerous federal, tribal, State, and local agencies and organizations.
- Patchwork of unaligned agency planning, programs, projects, policies, and regulations.
- Unintended consequences from mismatching or conflicting policies or regulations.
- Inadequate sharing of data, information, and knowledge resulting from institutional silos.
- Duplication of effort, expertise, and resources.
- Focus on single-purpose projects.
- Inadequate partnerships among federal, State, tribal, local, private, and non-profit organizations.
- Project delays and mounting planning and compliance costs.

Understandably, project planning in California is technically complex and location-appropriate because of wide variations of climates, landforms, and institutions, as well as a diverse, place-based range of cultures associated with rural, suburban, and urban communities. Project partners, such as implementers and regulatory agencies, may have different perspectives on what they hope a project or program should achieve. Those responsible for operations and maintenance may have yet another perspective. Also, State and federal agencies may have different perspectives and responsibilities regarding a project.

The need for alignment is well understood among all levels of government and stakeholders. This CWP objective of strengthening agency alignment is based on several key principles:

- Agencies will remain autonomous.
- Action will be voluntary.
- No new institutions or organizations will be created to manage alignment.
- Action will occur at multiple organizational levels.
- No single agency can solve all of a project's or program's issues by itself.

Implementing the related actions for this objective, in coordination with other CWP objectives, will help achieve the following outcomes:

- Improved communication, coordination, and collaboration.
- Aligned planning, programs, projects, policies, and regulations for water and associated watershed, land, and ecosystem management.
- Shared processes, tools, data, information, knowledge, and expertise.
- Collaborative, place-based solutions using best available science, traditional knowledge, and other sources of information.
- Watershed-scale, multi-benefit water and resource stewardship programs to solve multiple resource issues.

- More public-private partnerships to advance all aspects of IWM (planning, project implementation, financing, monitoring, maintenance, data collection and exchange, analytical methods and tools, research, technology, and science).

A primary purpose for improving communication, cooperation, collaboration, and alignment among government agencies is to expedite efficient and cost-effective implementation of resource management strategies and multi-objective projects. This includes collaboration with regulatory agencies to reduce time and avoid costs to implement IWM projects while protecting and enhancing natural resources. Achieving IWM requires that data management, planning, policy-making, and regulation occur in a very collaborative, consistent, and regionally appropriate manner.

Instead of creating new institutions or organizational structures to manage alignment, agencies are encouraged to utilize simple self-organizing principles, practices, and tools to coordinate and collaborate outside of traditional silos and hierarchical management approaches. Alignment should not alter agencies' authority or responsibility, and is achieved by agencies working together — early and often. For example, a collaboration has been established between the 42-member California Biodiversity Council (www.biodiversity.ca.gov) and the Update 2013 process to better align planning processes and more efficiently interact with federal, State, and local agencies. One result was a joint convening of the Workshop to Align Agency Conservation Plans, Policies, and Programs held in October, 2012. The outcome of this workshop led to the February 6, 2013, California Biodiversity Council Meeting in Davis, California, where the co-chairs committed to a new resolution for the Council, *Strengthening Agency Alignment for Natural Resource Conservation*, described further in Chapter 4, “Strengthening Government Alignment.”

One of the related actions offers strategies for improving the alignment, effectiveness, and implementation of water regulations. It recommends agencies set regulations that focus on regionally appropriate outcomes (goals or targets — the What), establish performance measures/indicators to evaluate progress, and include an adaptive management approach as a part of compliance. The action also recommends that the regulatory agency give regional collaboratives, such as the IRWM Regional Water Management Groups or Resource Conservation Districts, an option to develop an implementation and monitoring plan that describes the resource management strategies the group will use to achieve the regulations' intended outcomes in their area of the state (the How).

Related Actions

16.1 To advance IWM, federal, State, tribal, and local government agencies should strengthen alignment among their data, plans, programs, policies, and regulations. More specifically, they should:

- 16.1.1 Collaborate to develop consistent policies for advancing IWM at a regional scale, and use a broad and diverse mix of administrative tools to implement their policies, including technical assistance and data support; financial incentives; and State funding, guidelines, and regulations.
- 16.1.2 Adopt the “Strengthening Agency Alignment for Natural Resource Conservation” resolution (April 2013) vision, goals and principles, developed with extensive input from 42 federal and State agencies, including multiple Water Plan State Agency Steering Committee members, among others.
- 16.1.3 Utilize the best practices and tools recommended in the “Strengthening Agency Alignment for Natural Resource Conservation” resolution.

- 16.1.4 Participate on the Biodiversity Council's Interagency Alignment Team.
- 16.2 State government should more effectively coordinate the work of multi-agency collaboratives, and utilize them to align and implement State water policies and promote IWM. This should include developing and maintaining a shared and easily accessible interagency inventory/repository of processes and tools for strengthening government agency alignment. Examples of multi-agency collaborative include, but are not limited to, the Strategic Growth Council, California Biodiversity Council, Delta Stewardship Council, Ocean Protection Council, Water Plan State Agency Steering Committee, Conservancies and Resource Conservation Districts, California Council on Science & Technology, and California Landscape Conservation Cooperative.
- 16.3 State government agencies should hire, assign, or train staff with collaboration and conflict resolution knowledge, skills, and abilities (KSA), whose primary job is to work with other federal, State, tribal, regional, and local agencies, organizations, and communities to improve interagency communication, cooperation, collaboration, and alignment.
- 16.3.1 California Department of Human Resources (Cal-HR) should convene an interagency working group to develop standard language describing collaboration and conflict resolution KSAs for use in duty statements where this core competency is a minimum qualification.
- 16.3.2 State agencies should include this standard KSA language in duty statements for staff and management classifications to promote State agency collaboration and alignment, and they should require incumbents in these classifications to complete facilitation training.
- 16.4 Federal and State government agencies should use a more inclusive, collaborative, and outcome-based approach for setting consistent and aligned water policies and regulations that are regionally appropriate. More specifically, they should:
- 16.4.1 Recognize regional and local diversity by assisting, enabling, and empowering regional water collaboratives, such as Regional Water Management Groups (IRWM) and Resource Conservation Districts, to determine *how* State water policies are implemented in their planning regions and/or watersheds.
- 16.4.2 Focus on intended and regionally appropriate outcomes (goals and objectives) when setting water policies, regulations, guidelines, and resource management plans for California. Agencies should establish performance measures/indicators to evaluate progress toward achieving desired outcomes, and include an adaptive management approach as a part of regulatory compliance.
- 16.4.3 Provide a voluntary program for regional collaboratives, such as Regional Water Management Groups (IRWM) and Resource Conservation Districts, to develop an implementation and monitoring plan that describes the resource management strategies (actions) the group will implement to achieve the regulations' intended outcomes in their planning regions and/or watersheds, as appropriate for their local conditions and resources.
- 16.4.4 Utilize voluntary, outcome-based and system-scale (watershed and ecosystem) approaches for regulatory and permitting processes, and engage project proponents collaboratively, earlier and more often during the process.
- 16.4.5 DWR and other State agencies should survey regional collaboratives, such as Regional Water Management Groups (IRWM), to determine what technical assistance they need to facilitate collaboration and support change in regulatory approaches.

- 16.5 The State should convene regulatory working groups, in collaboration with federal, tribal, and local governments, to improve and streamline regulatory review and permitting processes for implementing IWM projects more expeditiously. These regulatory working groups should take the following actions in collaboration with regional stakeholders, while recognizing the unique differences among California’s geographical regions:
- 16.5.1 Identify critical resource needs of regulatory agencies necessary to adequately implement regulatory programs and proposed regulatory alignment actions to support IWM, including science, tools, data, policy, guidance, and agency personnel.
 - 16.5.2 Maximize the use of existing mechanisms such as habitat conservation plans and natural community conservation plans.
 - 16.5.3 Review and streamline permit processes to improve efficiency and reduce costs, delays, inconsistencies, and associated adverse impacts, and develop regional permitting processes for recurrent actions and operation and maintenance activities.
 - 16.5.4 Develop and adopt region-specific guidance on ecosystem restoration, water quality improvement, and environmental stewardship strategies to expedite review.
 - 16.5.5 Develop and adopt specific guidance to expedite emergency response and public safety projects for high-risk areas.
 - 16.5.6 Evaluate and adjust regulatory staff assignments to improve regulatory review and permitting processes at a regional scale, facilitate earlier staff involvement in planning phases for complex projects, and identify resource gaps.
 - 16.5.7 Compile, maintain, and utilize regional knowledge bases (data, information, and science), including information on endangered species, sensitive habitat, water quality, and other baseline information.
 - 16.5.8 Develop and maintain regional environmental mitigation databases and mitigation banks to address the varying mitigation requirements among multiple regulatory programs and agencies in each region and across regions.
 - 16.5.9 Develop a multi-agency permitting guidebook that includes a description of the relevant permits, permit applications, and permitting guidance for common and more routine IWM projects.

**PLACEHOLDER Table 8-16 Related Actions and Performance Measures for Objective 16
(Strengthen Alignment of Government Processes and Tools)**

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of this chapter.]

Objective 17 — Improve Integrated Water Management Finance Strategy and Investments

State government uses consistent, reliable, and diverse funding mechanisms with an array of revenue sources to support statewide and regional IWM activities. State government also makes future investments in innovation and infrastructure (green and grey) based on an adaptive and regionally appropriate prioritization process.

This objective and the related actions are based on collaboration involving several State agencies, advisory committees, topic-based caucuses (particularly the Update 2013 Finance Caucus), and other CWP stakeholders who, together, developed a Finance Planning Framework (Framework), a new feature of the CWP. The Framework provides a logical structure and sequence for financial plan development. The related actions in this section were developed to respond to and leverage the challenges and

opportunities that emerged during the Update 2013 finance planning effort, as detailed in Chapter 7, “Finance Planning Framework.”

The scope of the related actions is limited to IWM programs and projects directly administered by the State, as well as future State IWM loans and grants distributed as incentives to regional and local governments. These actions are intended to inform and guide State government investment and finance. They are not intended to direct regional or local finance decisions. They also are not intended to modify existing State investment frameworks for ongoing financial activities, such as distribution of currently authorized General Obligation bonds. While the actions below include recommendations for enhancing the way the State invests in IWM, they do not include recommendations for new revenue sources. Chapter 7 and related action #7 provide a path for resolving issues and filling information gaps, which is required as a precursor to proposing new or enhanced revenues.

Continuing to use and advance the Update 2013 Framework will enable stakeholders to collectively and in context consider the issues to be addressed and the decisions to be made. The Framework discussed in Chapter 7 evolved as stakeholders worked together to create a common understanding of California’s water financing picture. Using a storyboard format, the goal was to establish a financing baseline and shared meaning about the past and current situation.

The related actions, shown in Table 8-17, are intended, in part, to incorporate several aspects of the Framework in State government actions. For example, the Shared Finance Values for State Investment and Prioritization have been represented, where appropriate. These values were developed collaboratively through the Update 2013 Finance Caucus and, in addition to guiding the development of the related actions (Table 8-17), are to be used in guiding IWM decisions regarding investment of State government funds. Another overlying purpose of these related actions is to increase the certainty that investments will achieve the intended benefits, improve the return on State investment, and enhance accountability by:

- Increasing the reliability, predictability, and level of State IWM funding for statewide and regional water programs and projects.
- Providing a consistent method for allocating, awarding, and disbursing State funding for water innovation and infrastructure programs and projects.
- Using competitive incentive programs instead of funding earmarks.
- Including regional accounts to continue IRWM to increase flexibility, reflect local and regional conditions, and advance regional goals and investment priorities.
- Providing proactive planning that implements consistent rules and standards for allocating State funding.

Related Actions

17.1 Regional and local entities should continue investing in IWM activities based on regional and local conditions, goals, priorities, and solutions.

Reliable and effective water finance planning should continue at the regional and local levels in partnership with State government. Locally sponsored initiatives will continue to be a cost-effective approach for planning and implementing IWM innovation and infrastructure (green and grey) to provide multiple benefits to their respective jurisdictions. Regional and local investments should be augmented and amplified with federal and State public funding.

17.2 State government should continue to provide incentives for regional IWM (IRWM) activities that achieve State goals or provide broad public benefits.

This includes assisting regions technically and financially to implement their IRWM plans and/or help achieve State government goals and interests. State government should continue to enhance incentives for regional activities and invest in infrastructure (green and grey) that provides a public benefit *and* would not otherwise be cost effective.



17.3 State government should improve and facilitate access to federal and State public revenue sources.

17.3.1 State government should develop a central online resource catalog to describe different funding programs, potential IWM revenue sources, and a how-to guide explaining how to apply for funding from these programs.

17.3.2 State government should provide guidance and assistance to local agencies on how to apply for funding that includes technical and financial assistance, as well as training for regions that do not have the capacity or resources to apply for funding or manage grants.

17.3.3 State government should inventory federal funding sources and provide guidance for partnering with, or leveraging, federal funding.

17.4 The governor and the Legislature should broaden the ability of (and create guidelines and limitations for) public agencies to partner with private agencies, entities, and organizations for IWM investments.

New policies are required to overcome the following limitations that have restricted their use:

17.4.1 Private financing rates are generally higher due to tax effects. Local bond financing options would typically be tax exempt for the bondholder and therefore have lower interest rates.

17.4.2 The prohibition of their use for State government projects restricts public-private partnerships (P3s) to local projects.

17.5 State government should develop a more reliable, predictable, and diverse mix of finance mechanisms and revenue sources to continue to invest in IWM innovation activities and infrastructure (green and grey) that have broad public benefits, including, but not limited to, General Funds and General Obligation bonds.

An important role of State government is to invest in innovation activities having broad public benefits that include improving State water governance, improving water planning and public engagement, investing in infrastructure (green and grey), strengthening government agency alignment, enhancing information technology (data and analytical tools), and advancing the use of water technology and science. These activities should be conducted in collaboration with the ongoing regional and local innovation activities.

Finance mechanisms used for these IWM innovation activities should:

A. Improve cost effectiveness, efficiencies, and accountability.

B. Avoid stranded costs and funding discontinuity.

C. Leverage funding across State government agencies.

D. Increase certainty of desired outcomes.

E. Enable prioritization based on shared funding values, defined principles, goals, objectives, and criteria.

17.6 State government should reduce planning and implementation time frames and costs associated with IWM activities by clarifying, aligning, and reducing redundancies among State government agencies’ policies, incentive programs, and regulations.

17.6.1 Develop the scope and methodology and prepare a *Return on State Government Investment* report card through the CWP update collaborative process (5-year interval) that would track the occurrence of benefits/value derived from State government investments (and leveraged local investments) by using specific criteria and sustainability indicators.

17.6.2 Convene an interagency IWM finance alignment group that includes State planning, resource management, and regulatory agencies to identify and implement finance policies, procedures, and protocols for the enhancement of State government transparency, accountability, flexibility, and cost efficiencies. This effort would recommend ways to reduce duplication and fragmentation among State government agencies’ policies, incentive programs, regulations, and budgets.

17.7 The California Water Plan Update 2018 process will refine and advance the eight components of the Finance Planning Framework as described in the “Next Steps” section of Chapter 7, “Finance Planning Framework.”

Future work will cover each component of the Framework in the following ways:

- A. **IWM Scope and Outcomes (Component 1)** — Revisit, clarify, and adapt the scope of IWM to changing conditions and priorities.
- B. **IWM Activities (Component 2)** — Develop more specificity regarding the types of activities that State government should invest in with a clearer nexus to the types of anticipated benefits.
- C. **Existing Funding (Component 3)** — Continue to compile and synthesize data that tracks historical water-related expenditures across federal, State, and local governments in California.
- D. **Funding Reliability (Component 4)** — Work with the State Agency Steering Committee to identify where potential funding gaps exist between the State IWM activities described in component 2 and existing funding levels and sources. Collaborate with regional water management groups to do the same for regional and local IWM activities.
- E. **State Role and Partnerships (Component 5)** — Continue to clarify and elaborate on the future role of State government to support a more specific description and estimate of future costs.
- F. **Future Costs (Component 6)** — Estimate future funding demands by (a) launching IRWM, city, county, and special district data pull; and (b) work with State Agency Steering Committee to estimate the funding demand for existing and future IWM activities.
- G. **Funding, Who and How (Component 7)** — Continue to collaborate with stakeholders and federal, State, tribal, and local governments to investigate and develop solutions that address the facts and findings detailed in Chapter 7, “Finance Planning Framework.” This work will include, but will not be limited to:
 - i. Funding methods that provide a consistent financing framework for State government investments in IWM.
 - ii. A prioritization method and rationale for apportioning IWM investment by the categories and subcategories developed in the Update 2013 Finance Planning Framework (i.e., Innovation, Infrastructure).
 - iii. Methods for enhancing stewardship of State government monies at both statewide and regional scales, including strategies to improve the transparency and accountability of State fund disbursements.
 - iv. Achieve the improvements described in related action #5.

H. **Trade-Offs (Component 8)** — State government should develop a Decision Support System (DSS) to provide guidance and leadership for defining uncertainties of future cost, benefits, prioritization, and other tradeoffs. The DSS would inform prioritization of State government expenditures, estimation of expected IWM benefits, and methods for apportioning costs across financiers. It also includes developing a clear and consistent methodology for identifying public benefits associated with the entire range of IWM activities.

**PLACEHOLDER Table 8-17 Related Actions and Performance Measures for Objective 17
(Improve Integrated Water Management Finance Strategy and Investments)**

[Any draft tables, figures, and boxes that accompany this text for the public review draft are included at the end of this chapter.]

References

References Cited

- Association of California Water Agencies. 2013. *Policy Principles on Improved Management of California's Headwaters*. [Web site.] Viewed online at:
<http://www.acwa.com/sites/default/files/post/policy-principles/2013/04/ca-headwaters-policy.pdf>. Accessed:
- California Air Resources Board. 2008. *Technologies and Policies to Consider for Reducing Greenhouse Gas Emissions in California*. Economic and Technology Advancement Advisory Committee (ETAAC), final report. Chapter 7. "Forestry Sector." [Web site.] Viewed online at:
<http://www.arb.ca.gov/cc/etaac/ETAACFinalReport2-11-08.pdf>. Accessed:
- California Department of Fish and Game. 2007. *California Wildlife Action Plan*. [Web site.] Viewed online at: <http://www.dfg.ca.gov/SWAP/2005/docs/SWAP-2005.pdf>. Accessed:
- California Department of Fish and Game. 2011. *Conservation Strategy for Restoration of the Sacramento–San Joaquin Delta Ecological Management Zone and the Sacramento and San Joaquin Valley Regions*. [Web site.] Viewed online at:
<http://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=31232>. Accessed:
- California Natural Resources Agency. 2009. *2009 Climate Adaptation Strategy*. Chapter 5, "Biodiversity and Habitat." [Web site.] Viewed online at:
http://resources.ca.gov/climate_adaptation/docs/Statewide_Adaptation_Strategy.pdf. Accessed:
- San Francisco Estuary Partnership. 2007. *San Francisco Estuary Project Comprehensive Conservation and Management Plan*. Chapter 2. Program Area: "Dredging and Waterway Modification." 245 pp. [Web site.] Viewed online at:
<http://www.cakex.org/sites/default/files/San%20Francisco%20Estuary%20Project.pdf>. Accessed:
- Tribal Communication Committee. 2008. *Tribal Communication Plan*. Working draft, developed in support of California Water Plan Update 2009 (California Department of Water Resources).


1 [Web site.] Viewed online at:
2 http://www.waterplan.water.ca.gov/docs/cwpu2009/0310final/v4c19a07_cwp2009.pdf. Accessed:
3

Table 8-1 Related Actions and Performance Measures for Objective 1 (Strengthen Integrated Regional Water Management Planning)

[table to come]

[These related actions are under development and will include actions and recommendations from the IRWM Strategic Plan, when available.]

Table 8-2 Related Actions and Performance Measures for Objective 2 (Use and Reuse Water More Efficiently)

Related Actions	Performance Measures	 Entities	Funding Status	Legislation Required (X for Yes)
2.1 The State should expand public information efforts to promote water conservation in both the urban and agricultural sectors to better inform all Californians about the importance and value of water and about ways to use water more efficiently. The expanded campaign should be designed with specific informational goals and objectives and should operate on a continuous basis in wet years as well as dry years. This campaign will assist local water suppliers and the State in achieving the 2020 water use targets.	<p>A. DWR and ACWA prepare expanded “Save Our Water” campaign plan, including both traditional and social media forums. Use advertising industry measures and metrics to develop and achieve informational and educational goals.</p> <p>B. Conduct a series of annual regional and crop specific water management workshops in cooperation with California academic institutions, such as the University of California and California State University, and resource conservation districts to provide growers the latest information on new irrigation technology and practices.</p>	DWR and ACWA	Partially Funded	Yes for additional funding
2.2 DWR, with the California Urban Water Conservation Council (CUWCC) and the State Water Resources Control Board (SWRCB), should research and promote water rate structures that provide conservation price signal to customers while maintaining revenue stability for the water utilities.	<p>A. Provide financial and technical support to the CUWCC for the development of one or more computer-based tools that could be used by water supplier staff.</p> <p>B. Provide technical support for communicating the benefits of alternate water pricing strategies.</p>	DWR	Unfunded	
<p>2.3 DWR, with the SWRCB and CDPH, should prepare a California Municipal Water Recycling Strategic Plan to guide expanded statewide use of recycled water to help sustain statewide water supplies. The strategic plan will include:</p> <p>2.3.1 Review and status of implementation of the 2003 Recycled Water Task Force findings.</p> <p>2.3.2 Regional assessment and quantification of current and proposed recycled water capacities and demands.</p> <p>2.3.3 Evaluation of better alignment of the level of treatment required for recycled water use in agricultural and environmental applications to create more opportunities for recycled water use and reduce the energy required to produce recycled water.</p>	<p>A. Establish a stakeholder committee, including SWRCB, CDPH, water suppliers, organizations, and the public.</p> <p>B. Prepare a review and status of the</p> <p>C. 2003 Recycled Water Task Force findings and recommendations.</p> <p>D. Prepare regional assessments for each hydrologic region identifying regional strategies, such as institutional issues, costs, water quality, and markets</p> <p>E. Compile identified barriers to expanding local</p>	DWR	Unfunded	

Related Actions	Performance Measures	Lead Entities	Funding Status	Legislation Required (X for Yes)
<p>2.3.4 Consideration of potential groundwater degradation issues and coordination with Salt and Nutrient Management Plan implementation.</p> <p>2.3.5 Regional evaluation of barriers to additional recycled water use and proposing solutions, including indirect and direct potable reuse issues, to support continued expansion of recycled water use.</p>	<p>and statewide recycled water use.</p> <p>F. Identify regional and statewide tools for local water suppliers to guide implementation of recycled water programs.</p> <p>G. Identify improved practices for implementing 'fit for use' measures into recycled water planning.</p> <p>H. Prepare final report (2015)</p>	DWR, SWRCB and others entities.	Unfunded	X
<p>2.4 The State should establish a water use efficiency and alternative supply research program to speed the development, testing, and implementation of promising new technology and approaches to water management. The program should conduct studies in all sectors of water use including agriculture, municipal and industrial, and in the alternative supply areas of recycling, greywater, stormwater capture, and desalination. The level of sponsored research should match that of the State's energy-use efficiency research programs.</p>	<p>A. Research program established</p> <p>B. Quantity and quality of research similar to energy use efficiency programs</p> <p>C. Research results in improved California water management.</p>			
<p>2.5 DWR should research and assist water suppliers in using new tools to measure landscape area. The landscape area data can be used to establish water budgets for customer accounts. Water suppliers can use the water budget program to better focus their water conservation efforts toward customers who are using excess water.</p>	<p>DWR helps identify cost effective landscape area measurement tools.</p>	DWR	Unfunded	
<p>2.6 DWR, in cooperation with urban water-use community, should conduct a study to identify the barriers, costs, and technical assistance required to establish standard urban water-use classifications for water use reporting. The standard classifications would allow for water supplier data to be more accurately aggregated at the regional and statewide levels and permit a more detailed and accurate reporting of California water use.</p>	<p>A. DWR conducts the classification study, barriers, costs and potential solutions for implementation are identified.</p> <p>B. Standard classifications implemented.</p>	DWR	Unfunded	X
<p>2.7 Agricultural and urban water suppliers should report water supply system leakage and spills in their water management plans. Agricultural suppliers should measure and report canal seepage and</p>	<p>Urban and agricultural water suppliers report distribution system leakage and spills and unaccounted for water in their 2015 water</p>	DWR	Partially Funded	

Related Actions	Performance Measures	Lead Entities	Funding Status	Legislation Required (X for Yes)
district outflows. Urban water suppliers should calculate and report unaccounted-for distribution system water.	management plans.			
2.8 All levels of government should establish policies and provide incentives to promote better urban runoff management and reuse. Urban and, where feasible, rural communities should invest in facilities to capture, store, treat, and use urban stormwater runoff, such as percolation to usable aquifers, underground storage beneath parks, small surface basins, in drains, or the creation of catch basins or sumps downhill of development. Depending on the source and application, captured stormwater may be suitable for use without additional treatment, or it may be blended to augment local supplies.	Implementation of low impact development increases significantly across the state	SWRCB	Partially Funded	

Table 8-3 Related Actions and Performance Measures for Objective 3 (Expand Conjunctive Management of Multiple Supplies)

Related Actions	Performance Measures	Lead Entities	Funding Status	Legislation Required (X for Yes)
3.1 Promote public education about California's groundwater.	<p>By July 1, 2016, DWR and SWRCB will work with other State, tribal, local, and regional agencies and organizations to develop a groundwater education program and materials for use in the schools and public outreach. Key educational concepts should include:</p> <ul style="list-style-type: none"> A. Groundwater supply variability. B. Interconnection of surface water and groundwater. C. Groundwater recharge benefits and challenges. D. Importance of protecting groundwater quality and recharge areas. E. Seasonal versus long-term changes in groundwater quantity. F. Importance of developing a groundwater budget. G. Potential impact of climate change on groundwater resources. 	DWR & SWRCB	Unfunded	
3.2 Improve collaboration and coordination among federal, State, tribal, regional, and local agencies and organizations to ensure data integration, coordinate program implementation, and minimize duplication of efforts.	<p>By January 1, 2017, and on an ongoing basis, DWR and the SWRCB will coordinate with State, federal, tribal, local, and regional agencies and organizations to conduct the following activities.</p> <ul style="list-style-type: none"> A. Provide State incentives to local water management agencies to coordinate with Tribes and other agencies involved in activities that may affect long-term sustainability of water supply and water quality. B. Outline and implement process to improve coordination and cooperation among State, federal, tribal, and local agencies to improve 	DWR, SWRCB, & local permitting agencies	Unfunded	X

Related Actions	Performance Measures	Lead Entities	Funding Status	Legislation Required (X for Yes)
3.3 Increase availability and sharing of groundwater information.	the process for timely regulatory approval, alignment of rules or guidelines, and environmental permitting for the development, implementation, and operation of conjunctive management, recharge, and water banking facilities.			
	C. Expedite environmental permitting for implementation of conjunctive management, recharge, and water banking facilities when facility operations increase ecosystem services, and includes predefined benefits/mitigation for wildlife and wildlife habitat.			
	D. Establish a process led by the SWRCB to identify measures whereby agencies proposing to use peak surface water flow for groundwater recharge are not subject to potential protest of their existing water right, in order to stipulate groundwater recharge as a reasonable beneficial use of their surface water right.			
	DWR will coordinate with State, federal, tribal, local, and regional agencies and organizations to conduct the following activities.	DWR, SWRCB, & OPR	Unfunded	X
	A. By January 1, 2016, Governor's Office of Planning and Research (OPR) will develop a coordination plan to disseminate groundwater information.			
	B. By January 1, 2016, the State of California will consider changes to Section 13752 of the California Water Code to improve public access to Well Completion Reports, while addressing key infrastructure security and private ownership concerns.			
	C. By January 1, 2018, State agencies will work collaboratively with water agencies, local permitting agencies, and driller organizations			

Related Actions	Performance Measures	Lead Entities	Funding Status	Legislation Required (X for Yes)
3.4 Strengthen and expand the California Statewide Groundwater Elevation Monitoring (CASGEM) Program for its long-term sustainability.	<p>to 1) develop an on-line Well Completion Report submittal system, 2) digitize and make publically available existing Well Completion Reports groundwater to allow improved analysis of groundwater data, and to 3) build upon efforts begun in 2012 to update well drilling, construction, and abandonment standards.</p> <p>D. By December 31, 2018, DWR will work with SWRCB to implement a web-based Water Planning and Information Exchange (Water PIE) system that will provide on-line access to groundwater supply and demand information, groundwater level and quality data, groundwater recharge and conjunctive management activities, groundwater management planning, land subsidence information, and groundwater basin studies.</p>			
	<p>A. By January 31, 2015, and renewable in each five-year cycle ending in 8 and 3, the State of California will commit long-term, dedicated funding to the CASGEM Program to implement monitoring, assessment, and maintenance of baseline groundwater levels data, and expand the program to include the fractured rock hydrogeology in areas deemed important.</p> <p>B. By January 31, 2015, and renewable in each five-year cycle ending in 8 and 3, the State will continue funding for local groundwater monitoring and management activities, and feasibility studies that increase the coordinated use of groundwater and surface water by giving priority to projects that include filling regional and Statewide data</p>			

Related Actions	Performance Measures	Lead Entities	Funding Status	Legislation Required (X for Yes)
	<p>gaps and conjunctive management conducted in accordance with an IRWM plan. Thus encourage or require and provide incentives to local water management agencies to implement groundwater monitoring programs to provide additional data and information needed to adequately characterize a groundwater basin, subbasin, aquifer or aquifers under the jurisdiction of the agency or adopted groundwater management plan.</p> <p>C. By December 31, 2018, the State will expand and fund CASGEM by including and implementing above recommendations as integral components of the Program, and thus use CASGEM as the vehicle to update and maintain groundwater information in the future.</p>			
3.5 Under the CASGEM Program, improve understanding of California groundwater basins by conducting groundwater basin assessments of CASGEM high-priority basins in conjunction with the CWP 5-year production cycle.	<p>By December 31, 2018, DWR will coordinate with State, federal, tribal, local, and regional agencies to utilize the CASGEM Basin Prioritization information to conduct the following groundwater basin assessment activities.</p> <p>A. Develop the initial and reoccurring schedule and scope for groundwater basin assessments that will allow data and information sharing under the CWP five-year production cycle.</p> <p>B. Compile and evaluate new and existing groundwater supply and demand information, groundwater level and quality data, groundwater recharge and conjunctive management activities, surface water/groundwater interaction, groundwater management planning, land subsidence</p>	DWR	Unfunded	X

Related Actions	Performance Measures	Lead Entities	Funding Status	Legislation Required (X for Yes)
	<p>information, and existing groundwater basin studies, in accordance with the scope identified in (a).</p> <p>C. Develop detailed groundwater basin assessment reports by Hydrologic Region and groundwater basin. The reports will characterize sustainability of groundwater resources in terms of historical and existing trends, and future scenario projections, and will identify recommended incentives to establish basin-wide water budgets and adaptive management practices which will promote sustainable groundwater quantity, quality, and the maintenance of groundwater ecosystem services.</p> <p>D. Develop a summary report to California Legislature identifying the <i>State of California's Groundwater</i> which will highlight key findings and recommendations associated with detailed groundwater basin assessments by Hydrologic Region.</p>			
3.6 Conduct an assessment of all SB 1938 groundwater management plans and develop guidelines to promote best practices in groundwater management	<p>In coordination with State, federal, tribal, local, and regional agencies, DWR will conduct the following activities.</p> <p>A. By January 1, 2015, the Legislature will amend the appropriate code(s) to authorize DWR to evaluate and assess groundwater management and planning, and to develop groundwater management and implementation guidelines.</p> <p>B. By January 1, 2016, DWR will conduct outreach to local and regional agencies to</p>	DWR	Unfunded	X

Related Actions	Performance Measures	Lead Entities	Funding Status	Legislation Required (X for Yes)
	<p>supplement and verify Groundwater Management Plans (GWMP) inventory and information initiated by DWR as part of Water Plan Update 2013.</p> <p>C. By January 1, 2017, DWR will work with regional and local agencies to assess their GWMP implementation and practices, in accordance with existing California Water Code requirements to i) identify technical, legal, institutional, physical, and fiscal constraints associated with existing groundwater management programs, ii) identify opportunities associated with groundwater management and planning activities, and iii) gain an understanding of how agencies are implementing actions to use and protect groundwater.</p> <p>D. By January 1, 2018, DWR will work with regional and local agencies to develop groundwater management and planning and program implementation guidelines. The guidelines will provide a clear roadmap for GWMP development and implementation by identifying and clarifying components, processes, and standards and by establishing provisions for periodic review, report, update, and amendment as necessary to facilitate effective and sustainable groundwater management. The guidelines will also emphasize groundwater management in coordination with or as part of an IRWM plan.</p> <p>E. By December 31, 2018, DWR will develop a GWMP Advisory Committee and begin coordination with regional and local agencies and tribal communities that have not developed basin-wide GWMPs, to develop</p>			

Related Actions	Performance Measures	Lead Entities	Funding Status	Legislation Required (X for Yes)
3.7 Develop analytical tools to assess conjunctive management and groundwater management strategies.	<p>such plans with assistance and guidance from the GWMP Advisory Committee. The GWMP Advisory Committee will help guide the development, educational outreach, and implementation of the GWMPs. Advanced tools development should be pursued as part of this activity to help quantify benefits and assess robustness of alternative management strategies.</p> <p>By December 31, 2018, DWR and the SWRCB, in collaboration with State, federal, tribal, local, and regional agencies will conduct the following activities.</p> <ul style="list-style-type: none"> A. Develop a conjunctive management tool that will help identify conjunctive management opportunities (projects) and evaluate implementation constraints associated with the i) availability of water for recharge, ii) available means to convey water from source to destination, iii) water quality issues, iv) environmental issues, v) jurisdictional issues, vi) costs and benefits, and vii) the potential interference between a proposed project and existing projects. B. The State will encourage or require local and regional agencies to develop or adopt analytical tools to support integrated groundwater/surface water modeling and scenario analysis for assessing alternative groundwater management strategies as part of their IRWM planning activities. 	DWR & SWRCB	Unfunded	

Related Actions	Performance Measures	Lead Entities	Funding Status	Legislation Required (X for Yes)
3.8 Increase statewide groundwater recharge and storage by two (2) million acre-feet (maf) (current average annual statewide groundwater use is about 16 maf).	<p>In coordination with State, federal, tribal, local, and regional agencies, the following activities will occur.</p> <ul style="list-style-type: none"> A. By January 1, 2016, the Legislature revises the Water Code to i) include disincentives to overdraft groundwater basins and ii) include incentives for increasing recharge. B. By January 1, 2017, DWR will compile, assess, and provide status update on Statewide aquifer recharge area delineation and mapping required by AB 359 and to identify priority recharge areas. C. By January 1, 2017, State agencies will work with federal, Tribal, local, and regional agencies to i) develop guidelines clarifying interagency alignment and improved interagency coordination to facilitate local groundwater recharge and storage projects, ii) develop guidelines for coordinating and aligning land use planning with groundwater recharge area protection, and iii) catalogue best science and technologies applied to groundwater recharge and storage. D. By January 1, 2018, DWR and SWRCB will compile available data, identify missing data needed to evaluate natural groundwater recharge, discharge, related ecosystems, and groundwater recharge and storage projects, and develop a plan to fill identified data gaps to support evaluation of groundwater recharge and storage. E. By January 1, 2018, and on an ongoing basis, the State of California will encourage local and regional agencies - when technically, legally, and environmentally feasible – to manage the use of available 	DWR & SWRCB	Unfunded	X

Related Actions	Performance Measures	Lead Entities	Funding Status	Legislation Required (X for Yes)
	<p>aquifer space for managed recharge and develop multi-benefit projects that generate source water for groundwater storage by capturing water not used by other water users or the environment.</p> <p>F. By December 31, 2018, the State of California will encourage and fund local and regional agencies, and tribal communities to i) identify and evaluate local and regional opportunities to reduce runoff and increase recharge on residential, school, park, and other unpaved areas, ii) coordinate groundwater recharge and multi-benefit flood control projects to enhance recharge using storm flows, and iii) conduct pilot studies (one regional and one inter-regional) to identify additional opportunities and needs for advancing recharge opportunities.</p>			
3.9 Evaluate reoperation of the state's existing water supply and flood control systems.	<p>In collaboration with willing participants, DWR will complete a System Reoperation Study by 2015. The study will evaluate and document the potential options for reoperation of the State's existing water supply and flood control systems to achieve the objectives of improved water supply reliability, flood hazard reduction, and ecosystem protection and enhancement. The reoperation options will focus on integrating flood protection and water supply systems, reoperating the existing water system in conjunction with effective groundwater management, and improving existing water conveyance systems.</p>	DWR	Full	X
<p>3.10 DWR and the U.S. Bureau of Reclamation (USBR) should:</p> <p>3.10.1 Complete the North-of-the-Delta Offstream Storage, Shasta Lake Water Resources, and Upper San Joaquin River Basin Storage investigations.</p>	<p>Progress on completing: (A) the North-of-the-Delta Offstream Storage, Shasta Lake Water Resources, and Upper San Joaquin River Basin Storage investigations by the end of 2015, (B) the investigation of the further enlargement of the Los Vaqueros Reservoir by the end of 2016, (C) the San Luis</p>	DWR & USBR	Partially Funded	X

Related Actions	Performance Measures	Lead Entities	Funding Status	Legislation Required (X for Yes)
3.10.2 Complete the investigation of the further enlargement of the Los Vaqueros Reservoir.	Reservoir expansion investigation by the end of 2016.			
3.10.3 USBR, in collaboration with DWR, should complete an investigation to enlarge/raise BF Sisk Dam and San Luis Reservoir.	<p>The above projects will also:</p> <ul style="list-style-type: none"> A. Evaluate the potential additional benefits of integrating operations of new storage with proposed Delta conveyance improvements, and recommend the critical projects that need to be implemented to expand the State's surface storage. B. Identify the beneficiaries and cost share partners for the non-public benefits by 2015. C. Request funding from the water bond for the public benefits portion through the California Water Commission by 2016, if a State water bond passes in 2014 			

Table 8-4 Related Actions and Performance Measures for Objective 4 (Protect and Restore Surface Water and Groundwater Quality)

Related Actions	Performance Measures	Lead Entities	Funding Status	Legislation Required (X for Yes)
4.1 Protect and restore surface water quality by implementing strategies to protect the past, present, and probable future beneficial uses for all 2010-listed (Clean Water Action Section 303[d]) water bodies by 2030.				
4.1.1 Implement a statewide strategy to efficiently prepare, adopt, and implement total maximum daily loads (TMDLs), which result in water bodies meeting water quality standards, and adopt and begin implementation of TMDLs for all 2010-listed water bodies by 2019.				
4.1.2 Manage urban runoff volume to reduce pollutant loadings, reduce wet weather beach postings and closures by 75 percent by 2020, eliminate dry weather beach closures and postings and, where applicable, promote stormwater capture and re-use for development of sustainable local water supplies.				
4.1.3 Take appropriate enforcement actions and innovative approaches as needed to protect and restore the beneficial uses of all surface waters.				
4.2 Protect and restore groundwater quality by improving and protecting groundwater quality in high-use basins by 2030.				
4.2.1 Communities should implement an integrated groundwater protection approach to improve and protect groundwater in high-use basins that:				
A. Evaluate and regulate activities that impact or have the potential to impact beneficial uses.				
B. Recognize the effects of groundwater and surface water interactions on groundwater quality and quantity.				
C. Encourage and facilitate local management of groundwater resources.				
4.2.2 State government should identify strategies to ensure that communities with contaminated groundwater have a clean and reliable drinking water supply, which may include remediation of polluted or contaminated groundwater, surface water replacement, and/or groundwater treatment.				
4.2.3 State government should implement the recommendations in the SWRCB's Report to the Legislature on addressing issues associated with nitrate contaminated groundwater.				
4.2.4 The SWRCB and Regional Water Quality Control Boards (RWQCBs) should maintain high-quality groundwater basins through application of antidegradation directives using waste discharge requirements (WDRs) and the remediation of				

Related Actions	Performance Measures	Lead Entities	Funding Status	Legislation Required (X for Yes)
<p>polluted or contaminated groundwater.</p> <p>4.2.5 Regional and local stakeholders should prepare salt and nutrient management plans for each groundwater basin/subbasin in California by 2016. These salt/nutrient management plans should be prepared as outlined in the SWRCB's Water Quality Control Policy for Recycled Water adopted May 14, 2009, the purpose of which is to increase the use of recycled water from municipal wastewater sources that meets the definition in California Water Code section 13050(n), in a manner that implements State and federal water quality laws. The RWQCBs should incorporate salt and nutrient management plans into basin plans, where appropriate.</p> <p>4.3 Comprehensively address water quality protection and restoration, and the relationship between water supply and water quality, and describe the connections between water quality, water quantity, and climate change, throughout California's water planning processes.</p> <p>4.3.1 As part of the CWP, the SWRCB should prepare a comprehensive water quality policy to guide the State's water management activities, including protection and restoration of water quality through the integration of statewide policies and plans, regional water quality control plans (basin plans), and the potential effects of climate change on water quality and supply.</p> <p>4.3.2 RWQCBs should consistently organize basin plans to provide a clear structure that readily conveys key elements (e.g., beneficial uses, potential impacts of climate change, water quality objectives, goals for watersheds, plans for achieving those goals, and monitoring to inform and adjust the plans) and that fully integrates other water quality control plans such as the California Ocean Plan and Water Quality Control Plan for Enclosed Bays and Estuaries.</p> <p>4.3.3 RWQCBs should adopt basin plan amendments through a collaborative process that involves third parties and incorporates SWRCB requirements and stakeholder interests. An example is the Santa Ana RWQCB's Basin Plan amendment initiated with funding assistance from stakeholders as required in the SWRCB's Recycled Water Policy.</p> <p>4.3.4 State Government should continue to support efforts of the California Water Quality Monitoring Council to develop a centralized Geographic Information System (GIS) database (EcoAtlas) that displays watershed information including watershed boundaries, TMDLs, monitoring data, water body types, assigned BUs, wetlands, California Rapid Assessment Method scores, vegetation types, and other data. A key component of effective water quality planning is access to pertinent watershed information so that regulatory</p>				

Related Actions	Performance Measures	Lead Entities	Funding Status	Legislation Required (X for Yes)
actions can strategically protect and improve watershed aquatic resources.				
4.4 To protect source water and safeguard water quality for all beneficial uses, State government should implement the recommendations from the following CWP Resource Management Strategies found in Volume 3: pollution prevention, matching water quality to use, salt and salinity management, urban stormwater runoff management, groundwater/aquifer remediation, recharge area protection, municipal recycled water, and drinking water treatment and distribution.				
4.5 CDPH will continue to implement its Small Water System Program Plan to assist small water systems (especially those serving disadvantaged communities) that are unable to provide water that meets primary drinking water standards.				
4.5.1 CDPH will share the Small Water System Program Plan with relevant federal, tribal, State, regional, and local agencies, as well as stakeholders, to foster additional opportunities for funding, coordinate construction projects in communities, and to assist in local and regional planning efforts.				
4.5.2 CDPH will utilize GIS tools to identify large water systems in close proximity to targeted small water systems, and conduct targeted outreach to these large water systems to encourage them to consolidate the small systems into their service area.				
4.5.3 CDPH will work with stakeholders to identify obstacles to consolidation (including financial, legal, and local issues) and develop possible actions to address these obstacles.				
4.5.4 CDPH will participate in statewide planning efforts to address the water infrastructure needs of small water systems. CDPH should seek input from other states and the federal government on innovative, successful efforts to address the needs of small water systems, and should share its results on implementation of its Small Water System Program Plan.				

Table 8-5 Related Actions and Performance Measures for Objective 5 (Practice Environmental Stewardship)

Related Actions	Performance Measures	Lead Entities	Funding Status	Legislation Required (X for Yes)
<p>5.1 Governments and the private sector should work together to create and maintain a network of protected reserve areas across the state that builds on existing conservation investments, and provides refuge areas and migration corridors that allow species to adjust to conditions associated with climate change. The network should include river corridors that connect high elevations to valleys and reestablish natural hydrologic connections between rivers and their historic floodplains. (California Natural Resources Agency 2009)</p>	<p>A. Cumulative number of acres protected in each eco-region.</p> <p>B. Connectivity score of areas protected in each eco-region.</p> <p>C. Percentage completion of a tracking system of lands that are a priority for protection.</p>	Natural Resources Agency	Partially Funded	
<p>5.1.1 The California Natural Resources Agency should develop and implement a comprehensive tracking system to identify the lands that already are protected and lands that are a priority for protection.</p>				
<p>5.2 All agencies that own and operate water and flood management systems should include actions in their respective natural resource management plans that restore natural processes of erosion and sedimentation in rivers and streams and increase the quantity, diversity, quality, and connectivity of riverine and floodplain habitats. Local planning activities, including integrated regional water management (IRWM), urban water management plans, watershed management plans, natural community conservation plans, habitat conservation plans, and other water resource or floodplain focused planning efforts, should include objectives to meet these goals.</p>	<p>A. Number of acres of riparian and floodplain habitat restored annually.</p> <p>B. Number of acres of floodplain and upper watershed forest restored annually.</p> <p>C. Annual increase in number of plans that offer additional credits for habitat corridor connectivity and restoration.</p> <p>D. Percentage achievement of overall one-million acre goal.</p>			
<p>5.2.1 Re-establish one million acres of contiguous natural riparian, wetland, and floodplain habitat that is subject to periodic flooding for at least 50 percent of the river miles in the regions. This can contribute to Assembly Bill (AB) 32 GHG reduction goals through enhanced carbon sequestration. IRWM and regional flood management plans that incorporate corridor connectivity and restoration of native aquatic and terrestrial habitats to support increased biodiversity and resilience to a changing climate should receive additional credits in State government water and flood grant programs. (See objectives 1, 2, and 6)</p>				
<p>5.3 State and federal governments should encourage, prioritize, and identify financing for actions to protect, enhance, and restore at least one million acres of upper watershed forests and meadows that act as natural water and snow storage. These</p>	<p>A. Number of acres newly protected or treated for</p>			

Related Actions	Performance Measures	Lead Entities	Funding Status	Legislation Required (X for Yes)
actions should include efforts to reduce the risks and impacts of catastrophic wildfire. This measure improves water supply reliability, protects water quality, safeguards high-elevation habitats, and supports carbon sequestration and forest-based economies. (See objectives 1, 3, and 4.) (Association of California Water Agencies 2013; California Air Resources Board 2008)	fire risk each year. B. Percentage achievement of protecting, enhancing, and restoring one-million acres of upper watershed forests and meadows.			
5.4 Governments and the private sector should develop and support programs that pay private landowners and managers to protect and improve habitat and nature's water-related services, including flood protection, water quality, groundwater recharge and storage, reversal of land subsidence, prevention of large wildfires, shading of rivers and streams, and reduced soil erosion.	Number of acres newly enrolled each year; total acreage enrolled		Unfunded	
5.5 Governments and the private sector should work to incorporate the economic value of nature's goods and services into natural resource management decisions. Such recognition should include development of ways to measure the economic value of those services and the financial return from investment in their protection and enhancement.	A. Number of economic metrics developed for nature's goods and services B. Number of State programs (e.g., grants, mitigation, CEQA guidelines) that incorporate metrics	Natural Resources Agency	Unfunded	
5.6 Federal, state, and local agencies should provide greater resources and coordinate efforts to control invasive species and prevent their introduction. (California Department of Fish and Game 2007)	Progress toward decreasing trends in the number, abundance, and distribution of invasive species.			
5.7 State and federal government should work with dam owners/operators, tribes, and other stakeholders to evaluate opportunities and technologies to reintroduce anadromous fish to upper watersheds. Re-establishment of anadromous fish upstream of dams may provide flexibility in providing cold water downstream in conjunction with water and flood systems reoperation strategies. The State and federal governments should develop funding sources to support partnerships in constructing fish passage at dams and to assist removal of obsolete dams that pose a public safety and ecological risk.	Number of evaluations completed each year		Partially Funded	

Related Actions	Performance Measures	Lead Entities	Funding Status	Legislation Required (X for Yes)
<p>5.8 State, federal, and local government should identify and prioritize protection of lands of San Francisco Bay and the Delta that will provide the habitat range for tidal wetlands to adapt to and shift with sea level rise. A climate change resilient San Francisco Bay and Delta should include creating greater flood capacity by construction of setback levees on islands and removal of strategic island levees that also creates opportunities for tidal wetland and riparian restoration. Such lands and actions can help maintain estuarine ecosystem functions and act as storm buffers, protecting people and property from flood damages. (San Francisco Estuary Partnership 2007)</p>	<p>A. Number of acres of potential tidal wetland identified and prioritized for protection each year</p> <p>B. Total acreage so enrolled</p>			
<p>5.9 State government should prioritize and expand Delta islands and Suisun Marsh subsidence reversal and land accretion projects to help reestablish equilibrium between land and estuary elevations. Sediment-soil accretion is a cost-effective, natural process that can help sustain the Delta and Suisun Marsh ecosystem, and reduce communities' risks from flooding, as well as sequester carbon and restore estuarine ecosystem functions.</p>	<p>A. Number of acres newly enrolled in subsidence reversal projects each year</p> <p>B. Total acreage so enrolled</p>			
<p>5.10 State and federal government should fund natural resource protection agencies to continue work to determine fishery needs and provide funds for water right holders to meet those needs.</p>	<p>A. Progress towards developing statewide priorities for flow studies.</p> <p>B. Progress towards completing flow criteria for high priority watersheds.</p> <p>C. Amount of funding spent or made available to purchase water rights.</p> <p>D. Progress towards meeting target conditions for fish in priority streams.</p> <p>E. Progress towards meeting population targets for fish affected by these programs.</p>			

Table 8-6 Related Actions and Performance Measures for Objective 6 (Improve Flood Management Using an Integrated Water Management Approach)

Related Actions	Performance Measures	Lead Entities	Funding Status	Legislation Required (X for Yes)
6.1 Agencies at all levels should utilize IWM principles that consider flood risk, mitigation, and protection of natural floodplain functions for planning and implementing flood management projects. Collaborate with planners, engineers, scientists, regulators, and other stakeholders to identify flood risk reduction and floodplain restoration strategies that can be used in local and regional planning efforts such as general plans, regional economic and transportation plans, resource conservation plans, floodplain management plans, and others. This should include best management practices (BMPs) for coastal zones, alluvial fans, headwaters, and riverine floodplains in urbanized and non-urbanized areas.	Number of flood management plans and projects utilizing IWM principles completed.	S/F/L agencies	Partially Funded	
6.2 The State should prepare an update to the 2013 California's Flood Future Report: Recommendations for Managing the State's Flood Risk (California's Flood Future), which further advances the recommendations developed as part of the original California's Flood Future effort.	California's Flood Future Update	State (DWR)	Partially Funded	
6.3 Local agencies should work together in regions to develop regional flood risk assessments to evaluate potential adverse impacts of flooding on life, property, infrastructure, the environment, and the economy. The risk assessments should be developed through regional collaboration among local, state, and federal stakeholders, and based on a consistent methodology, appropriate to the region, for flood risk assessment. This assessment should include a determined acceptable level of flood risk for people, property, and the environment within the region. The flood risk assessments should include a set of digital maps for planning and communication of flood risk to agencies, the public, elected officials, and other stakeholders.	Population, total area, and number of regions covered by initiated or completed flood risk assessments with digital maps	Local agencies	Unfunded	
6.4 The State should develop comprehensive economic evaluation guidance for flood risk assessment and other flood management activities. The economic evaluation guidance should include methods to evaluate ecosystem services and other IWM benefits and should be adaptable to different areas of the state.				
6.5 Local agencies should work together regionally to develop regional flood risk management plans based on regional risk assessments and define short-term and long-term goals, objectives, actions, and associated implementation strategies for reducing flood risk, as well as define opportunities to enhance natural floodplain functions and provide other IWM benefits. These plans should reflect a collaborative, stakeholder-based process addressing the unique regional and statewide interests,	Population, total area and number of regions covered by initiated or completed regional and statewide floodplain management plans	Local FM agencies	Partially Funded	Potentially

Related Actions	Performance Measures	Lead Entities	Funding Status	Legislation Required (X for Yes)
critical needs, and priorities. These plans should address, as appropriate: the locally identified level of flood protection; flood risk and flood damage reduction and mitigation strategies, including natural floodplain function; operations and maintenance; and local, regional and state IWM strategies.				
6.6 The State should work with federal and local agencies to develop a statewide flood management investment approach. This approach would evaluate short- and long-term financing needs, as well as available investment strategies, and should layout potential future investment alternatives for flood management statewide. This action will also be informed by the outcomes of Objective 17.	Completion of statewide flood management investment approach	State (DWR)	Partially Funded	
6.7 The State should take appropriate action to facilitate revenue generation and support regional flood risk management. This includes as evaluation of existing financing mechanisms and legal frameworks to facilitate the development of regional flood-risk reduction financing.	White paper review of financial mechanisms and potential legislation changes	State		Potentially
6.8 The State should work with stakeholders to develop BMPs for land use planning that achieve flood risk reduction and protection of natural floodplain functions. The State should collaborate with planners, engineers, scientists, regulators, and other stakeholders. BMPs should be developed for local planning (e.g., general plans, land use regulations) that is conducted by cities and counties and for regional planning (e.g., sustainable communities strategies and blueprint plans) that is conducted by regional planning agencies. Land use planning BMPs should be developed for coastal zones, alluvial fans, headwaters, and riverine floodplains in urbanized and non-urbanized areas.	Initiation or completion of best management principles; number of workshops with land use planning stakeholders	State (DWR)		
6.9 The State should work with federal and local agencies to develop a comprehensive regional vulnerability analysis approach and set of regional adaptation strategies for climate change impacts on flood risk and floodplain ecosystems.	Climate change adaptation strategies for flood risk	State (DWR)		

Related Actions	Performance Measures	Lead Entities	Funding Status	Legislation Required (X for Yes)
6.10 The State should create and coordinate statewide and regional environmental regulatory working groups to improve and streamline regulatory review processes that will address critical flood risk reduction projects, flood system maintenance, flood emergency response, and floodplain restoration (see Objective 16). State and federal environmental regulatory agencies, in collaboration with regional stakeholders, should take actions to streamline regulatory review while recognizing the unique differences among geographical regions of the state.	<p>A. Number of regions with working groups and number/ types of environmental permitting processes reviewed, number and type of activities approved under the new processes with historical comparison</p> <p>B. Regional and/or statewide guidance for water quality and ecosystem restoration</p> <p>C. Number of regions and list of regulatory agencies engaging in baseline data sharing;</p> <p>D. Number of regions and list of agencies adopting a regional mitigation database and mitigation bank</p> <p>E. Permitting Guidebook</p>	State (DWR)		
6.11 The State should develop a comprehensive set of materials and tools to assist public agencies in obtaining accurate information on flood risk and floodplain conditions and increase public awareness of flood risks and potential IWM solutions in that region. The State should develop regional and statewide indicators of flood risk and floodplain conditions and create online regional and statewide flood risk and floodplain information resources for government agencies and for the public. These resources should include regional maps with information on flood risk and floodplain conditions and indicators; outreach and communication tools, including tailored outreach materials as needed to meet the unique needs of each region; and materials that clarify the roles and responsibilities of local, state and federal agencies in flood risk reduction and floodplain restoration efforts, including emergency response.	Catalog of floodplain maps; library of outreach materials; regional outreach materials	State (DWR)	Partially Funded	
6.12 The State should increase support for flood emergency preparedness, response, and recovery programs to reduce flood risk by identifying data and forecasting	Number of exercises and pre-planning meetings with locals; List	State (DWR)	Partially	

Related Actions	Performance Measures	Lead Entities	Funding Status	Legislation Required (X for Yes)
needs; conducting statewide flood emergency management (EM) exercises; working with locals to improve flood EM plans; and support increased coordination between flood EM responders, planners, facility managers, and resource agencies. (See Objective 8).	of agencies and type of staff attended meetings		Funded	
6.13 In June 2012, the Central Valley Flood Protection Board adopted the first Central Valley Flood Protection Plan (CVFPP). Prepared by DWR, the plan presents a long-term vision for improving integrated flood management in the Central Valley and achieving a more flexible, resilient, and sustainable flood management system over time. In implementing this vision, the State should take the following actions consistent with the goals of the CVFPP:	Completion of CVFPP and FCSSR Status Report Updates ULOP guidance published	State (DWR)	Full	
6.13.1 Update the CVFPP in years ending in 2 and 7.				
6.13.2 Continue to work with local and regional entities and the federal government to plan and refine physical improvements to the State Plan of Flood Control.				
6.13.3 Periodically update the Flood Control System Status Report (FCSSR), which provides information on the current status and conditions of State Plan of Flood Control facilities.				
6.13.4 Continue to develop criteria and guidance to assist local cities and counties in demonstrating an urban level of flood protection consistent with State law.				
6.13.5 Continue to develop policies, guidance, and funding mechanisms to implement flood management projects by using an IWM approach in the Central Valley.				
6.13.6 Continue to develop guidance and take actions to support wise management of floodplains and residual flood risks present in floodplains protected by the State Plan of Flood Control.				
6.14 In May 2013, the Delta Stewardship Council adopted the Delta Plan. The Delta Plan was developed to guide State and local agencies to help achieve the coequal goals of providing a more reliable water supply for California and protecting, restoring, and enhancing the Delta ecosystem. To support the implementation of the Delta Plan, the following flood-related actions should be taken:	Legislation implemented; TM evaluating floodway and bypasses and set-back levee alternatives;	Multiple	Unfunded	X
6.14.1 The Legislature should establish a Delta Flood Risk Management Assessment District with fee authority (including over State infrastructure).				
6.14.2 The Legislature should fund the State to evaluate and implement a bypass				

Related Actions	Performance Measures	Lead Entities	Funding Status	Legislation Required (X for Yes)
and floodway on the San Joaquin River near Paradise Cut.				
6.14.3 The State should evaluate whether additional areas both within and upstream of the Delta should be designated as floodways and should include the consideration of the anticipated effects of climate change in these areas.				
6.14.4 The State should develop criteria to define locations for future setback levees in the Delta and Delta watershed.				
6.14.5 The Legislature should require adequate levels of flood insurance for residences, businesses, and industries in flood-prone areas.				
6.14.6 The Legislature should consider statutory and/or constitutional changes that would address the State's potential flood liability.				
6.14.7 The U.S. Army Corps of Engineers (USACE) should consider a variance that exempts Delta levees from the USACE's levee vegetation policy.				
6.14.8 State and local agencies and regulated utilities that own and/or operate infrastructure in the Delta should prepare coordinated emergency response plans to protect the infrastructure from long-term outages resulting from failures of the Delta levees. The emergency procedures should consider methods that also would protect Delta land use and ecosystem.				

Table 8-7 Related Actions and Performance Measures for Objective 7 (Manage the Delta to Achieve the Coequal Goals for California)

Related Actions	Performance Measures	Lead Entities	Funding Status	Legislation Required (X for Yes)
7.1 State or local public agencies undertaking covered actions must file certifications of consistency with the Delta Stewardship Council. Certifications of Consistency must include detailed findings that demonstrate how the covered action is consistent with all the policies of the Delta Plan.	The number of covered actions filed with the Delta Stewardship Council	State and local agencies	unfunded	
7.2 Provide a more reliable water supply for California by implementing the following:	A. Identify number of urban and agricultural water suppliers that certify that they have adopted and are implementing supply planning, conservation, and efficiency measures required by State law by 2015, meeting the standards and deadlines established by code.	Local agencies	Unfunded (all)	
7.2.1 All water suppliers should fully implement applicable water efficiency and water management laws, including urban water management plans; the 20 percent reduction in statewide urban per capita water usage by 2020; agricultural water management plans; and other applicable water laws, regulations, or rules.	B. DWR has developed and published guidelines for the preparation of an expanded Water Supply Reliability Element.	DWR		
7.2.2 DWR, in consultation with the Delta Stewardship Council, the SWRCB, and others, should develop and approve guidelines for the preparation of a water supply reliability element as part of the update of an urban water management plan, agricultural water management plan, integrated water management plan, or other plan that provides equivalent information about the supplier's planned investments in water conservation and water supply development. The expanded water supply reliability element should include the details recommended in the Delta Plan. Water suppliers that receive water from the Delta watershed should include an expanded water supply reliability element in their water management plans, starting in 2015.	C. DWR and SWRCB have established an advisory group and identified impediments to achievement of statewide water conservation, recycled water and stormwater goals and have evaluated and recommended update goals, including an assessment of how regions are achieving their proportional share of these goals	DWR, DPH, SWRCB, others		
7.2.3 DWR and SWRCB should establish an advisory group with other state agencies and stakeholders to identify and implement measures to reduce impediments to achievement of statewide water conservation, recycled water, and stormwater goals. This group should evaluate and recommend updated goals for additional water efficiency and water resource development.	D. State grant and loan ranking criteria have been revised	DWR		
7.2.4 DWR, the SWRCB, the CDPH, and other agencies, in consultation with the Delta Stewardship Council, should revise State grant and loan ranking criteria to be consistent with Water Code section 85021 and to provide a priority for water suppliers that includes an	E. BDCP is completed and DWR and the Bureau of Reclamation have received required take permits	DWR		

Related Actions	Performance Measures	Lead Entities	Funding Status	Legislation Required (X for Yes)
expanded water supply reliability element in their adopted urban water management plans, agricultural water management plans, and/or IRWM plans.	F. DWR has completed the development and initiated implementation of an integrated statewide system for water use reporting in coordination with other state agencies.	DWR		
7.2.5 DWR and the USBR will complete the Bay Delta Conservation Plan (both the Habitat Conservation Plan/Natural Communities Conservation Plan and the Environmental Impact Report/Environmental Impact Statement), a 50-year ecosystem-based plan designed to restore fish and wildlife species in the Delta in a way that protects California's water supplies while minimizing impacts on Delta communities and farms. Upon adoption of the BDCP and receiving the necessary permits by the regulating agencies, DWR and the USBR will implement the 22 proposed conservation measures in the BDCP to help wildlife and reverse the decline of native fish populations in the Delta.	G. DWR has modified the California Water Plan update to include specified categories of information to be tracked.	DWR		
7.2.6 DWR, in coordination with the SWRCB, CDPH, Public Utilities Commission, Energy Commission, USBR, California Urban Water Conservation Council, and other stakeholders, should develop a coordinated statewide system for water use reporting. Water suppliers that export water from, transfer water through, or use water in the Delta watershed should be full participants in the database.	H. Funds are available in the IRWMP and LGAP programs for surface water improvement and GW data management			
7.2.7 DWR, in consultation with the SWRCB, and other agencies and stakeholders, should evaluate and include in the next and all future CWP updates information needed to track water supply reliability performance measures identified in the Delta Plan, including an assessment of water efficiency and new water supply development, regional water balances, improvements in regional self-reliance, reduced regional reliance on the Delta, and reliability of Delta exports, and an overall assessment of progress in achieving the coequal goals.				
7.2.8 Immediately provide financial incentives and technical assistance through the IRWM plans and the Local Groundwater Assistance Program to improve surface water and groundwater monitoring and data management.				
7.3 Water quality in the Delta should be maintained at a level that supports, enhances, and protects beneficial uses identified in the applicable SWRCB and RWQCB water quality control plans.			Unfunded (all)	
7.3.1 The SWRCB should update the Bay-Delta Water Quality Control Plan				

Related Actions	Performance Measures	Lead Entities	Funding Status	Legislation Required (X for Yes)
objectives as follows:				
A. By June 2, 2014, adopt and begin to implement updated flow objectives for the Delta that are necessary to achieve the coequal goals.		SWRCB		
B. By June 2, 2018, adopt, and as soon as reasonably possible, implement flow objectives for high-priority tributaries in the Delta watershed that are necessary to achieve the coequal goals.				
7.3.2 The SWRCB and RWQCBs should work collaboratively with DWR, DFW, and other agencies and entities that monitor water quality in the Delta to develop and implement a Delta Regional Monitoring Program that will be responsible for coordinating monitoring efforts so Delta conditions can be efficiently assessed and reported on a regular basis.	A. The SWRCB adopts Delta flow objectives by June 2, 2014. B. The SWRCB adopts flow objectives for the major tributaries in the Delta watershed by June 2, 2018	SWRCB		
7.3.3 DFW and other appropriate agencies should prioritize and implement actions for non-native invasive species from the <i>Conservation Strategy for Restoration of the Sacramento–San Joaquin Delta Ecological Management Zone and the Sacramento and San Joaquin Valley Regions</i> (California Department of Fish and Game 2011).	C. A Delta regional water quality monitoring program is developed. D. The Department of Fish and Wildlife and other appropriate agencies prioritize the list of “State 2 Actions for Nonnative Invasive Species.”	SWRCB, RWQCB		
		DFW		

Table 8-8 Related Actions and Performance Measures for Objective 8 (Prepare Prevention, Response, and Recovery Plans)

Related Actions	Performance Measures	Responsible / Lead Entity	Funding Status (Full, Partial, or Unfunded)	Legislation Required (X for Yes)
<p>8.1 Communities in floodplains should consider the consequences of flooding and should develop, adopt, practice, and regularly evaluate formal flood emergency preparedness, response, evacuation, and recovery plans (see Objective 6).</p> <p>A. State government should assist disadvantaged communities located in floodplains to prepare for and recover from flood emergencies.</p>		Local government & State government		
<p>8.2 Water shortage contingency plans prepared as part of the 2015 urban water management plans should increase drought planning from a 3-year drought to a 4-year drought, until more accurate information is available.</p>				
<p>8.3 By December 2014, DWR will update the California Drought Contingency Plan which includes:</p> <p>A. Articulation of a coordinated strategy for preparing for, responding to, and recovery from drought.</p> <p>B. Assessment of state drought contingency planning and preparedness.</p> <p>C. Description of State government's role and responsibilities for drought preparedness.</p> <p>D. Identification of needed improvements for drought monitoring and preparedness.</p> <p>E. Identification of measures to mitigate the economic, environmental, and social risks and consequences of drought events.</p> <p>F. Assessment of and adaptation to the impacts of drought under existing and future conditions, including climate change.</p> <p>G. Identification of needed improvements to real-time surface water and groundwater monitoring programs.</p> <p>H. Identification of needed research in drought forecasting.</p> <p>I. Identification of needed research of the indices and metrics for assessing the levels of drought.</p>				

Related Actions	Performance Measures	Responsible / Lead Entity	Funding Status (Full, Partial, or Unfunded)	Legislation Required (X for Yes)
8.4 DWR will work with the California Governor's Office of Emergency Services (Cal OES) to develop preparedness plans to respond to other catastrophic events, such as earthquakes, wildfires, chemical spills, facility malfunctions, and intentional disruption, which would disrupt water resources and infrastructure.				
8.5 Cal OES, the California Governor's Office of Planning and Research (OPR), and the California Natural Resources Agency should lead an effort to update the State Emergency Plan and State Multi-Hazard Mitigation Plan to strengthen consideration of climate impacts to hazard assessment planning, implementation priorities, and emergency responses.	A. Update the State Emergency Plan by 2015. B. Update the State Multi-Hazard Mitigation Plan by 2014	Cal OES		
8.6 Cal OES, DWR, and the Delta counties should work together to develop a catastrophic flood response plan for the Delta region. This plan should support an integrated response within the Delta and increase communication efforts between stakeholders and federal, State, tribal, local, and private agencies.	Complete first phase of the Northern California Flood Response Plan by 2014.	Cal OES & DWR		
8.7 Cal OES will work with appropriate agencies to update the San Francisco Bay Area Catastrophic Earthquake Response Plan and incorporate lessons learned from the 2013 Golden Guardian exercise.	Complete San Francisco Bay Area Catastrophic Earthquake Response Plan by 2013	Cal OES & FEMA		

Table 8-9 Related Actions and Performance Measures for Objective 9 (Reduce the Carbon Footprint of Water Systems and Water Uses)

[table to come]

[These related actions are under development and will include actions and recommendations from the updated WETCAT strategy, when available.]

Table 8-10 Related Actions and Performance Measures for Objective 10 (Improve Data, Analysis, and Decision-Support Tools)

Related Actions	Performance Measures	Lead Entities	Funding Status	Legislation Required (X for Yes)
To develop and use analytical tools more effectively, DWR should take the following actions, in coordination with the SWRCB, CDPH, Public Utilities Commission, Energy Commission, USBR, California Urban Water Conservation Council, California Council for Science and Technology, IRWM Regional Water Management Groups, and other agencies, organizations, tribes, and stakeholders.				
10.1 Expand the Central Valley Planning Area scale analytical tool and scenario studies developed during Update 2013 to assess future vulnerabilities and management responses in the other hydrologic regions for the California Water Plan Update 2018. The regional analytical tools and analysis should include evaluation of water supply reliability, water efficiency and new water supply development, regional water balances, improvements in regional self-reliance, reduced regional reliance on the Delta, and reliability of Delta exports. Over time, these tools should be enhanced to include water quality, economic, and biological metrics, as well as to evaluate a greater number of the resource management strategies in Volume 3.	A. Develop project charter. B. Number of DWR Planning Areas represented within the future scenario analysis. C. Number of resource management strategies represented within the future scenario analysis.	DWR	Partially Funded	
10.2 Develop a shared conceptual understanding, analytical framework, and quantitative description of how California watersheds and water management systems are represented in analytical tools at different spatial and temporal scales for use by federal, State, tribal, regional, and local agencies and organizations.	A. Develop project charter. B. Inventory of watershed hydrologic features and water management strategies that are represented within analytical tools.	DWR or research collaborative	Unfunded	
10.3 Support the California Water and Environmental Modeling Forum (CWEMF) in updating its 2000 modeling protocols and standards to provide more current guidance to water stakeholders and decision-makers, and their technical staff as models are developed and used to solve California's water and environmental problems.	Develop project charter.	CWEMF	Unfunded	
To improve water data and information, DWR should take the following actions, in coordination with the SWRCB, CDPH, Public Utilities Commission, Energy Commission, USBR, California Urban Water Conservation Council, California Council for Science and Technology, IRWM Regional Water Management Groups, and other agencies, organizations, tribes, and stakeholders.				
10.4 Establish standards and protocols for data collection and management that facilitate sharing of information among agencies and modeling studies. This would include identifying and cataloging existing water data for California, creating a water data dictionary, and developing standards and metadata for	A. Develop project charter. B. Inventory of existing water data for California. C. Developed water data	DWR or research collaborative	Unfunded	

Related Actions	Performance Measures	Lead Entities	Funding Status	Legislation Required (X for Yes)
water data monitoring, collection, and reporting.	dictionary.			
	D. Develop standards and metadata for water data monitoring, collecting, and reporting.			
10.5 Develop a strategic plan for data management that prioritizes long-term improvements in the monitoring network considering risk-based decision-making, and that identifies adequate resources for long-term maintenance and accessibility to water management information.	A. Develop project charter.	DWR or research collaborative	Unfunded	
	B. Criteria for prioritizing term improvements in the monitoring network.			
10.6 Improve drought planning and preparation by:	A. Develop project charter.	DWR	Partially Funded	
10.6.1 Developing drought metrics (indicators) with the goal of providing early detection and determination of drought severity.	B. Percent completion of items 10.6.1 to 10.6.5.			
10.6.2 Developing and improving monitoring of key indicators of regional water vulnerabilities.				
10.6.3 Improving the system of stream gauging for the purpose of managing water resources in low-flow conditions and improving the accuracy of seasonal runoff and water supply forecasts.				
10.6.4 Improving groundwater monitoring and assessment by providing technical and financial support to develop real-time monitoring of groundwater data.				
10.6.5 Expanding the existing surface water and groundwater monitoring networks, where needed.				
10.7 Develop a strategy and implementation plan for measuring and reporting water use and water quality data. The accurate measurement, timely publication, and broad distribution of water use and water quality will facilitate better water planning and management, especially in the context of managing aquifers more sustainably, and are necessary for the development of more accurate hydrologic budgets.	A. Develop project charter.	DWR or research collaborative	Unfunded	
	B. Inventory of existing water data for California.			
10.8 Sponsor science-based, watershed adaptation research and pilot projects to address water management and ecosystem needs, improve aquatic species and habitat monitoring, and develop an accessible and standardized database for reporting watershed and headwater conditions.	A. Develop project charter.	DFW	Unfunded	
	B. Develop criteria for selecting research and pilot projects.			
To improve data and information exchange, DWR should take the following actions, in coordination with the SWRCB, CDPH, Public Utilities Commission, Energy Commission, USBR, California Urban Water Conservation Council, California Council for Science and Technology, IRWM Regional Water Management Groups, and other agencies, organizations, tribes, and stakeholders.				

Related Actions	Performance Measures	Lead Entities	Funding Status	Legislation Required (X for Yes)
10.9 Develop the Water Planning Information Exchange (Water PIE) to facilitate sharing data and networking existing databases among federal, State, tribal, regional, and local agencies and governments, nonprofit organizations, and citizen monitoring efforts. The Water PIE data framework will help improve analytical capabilities and develop timely surveys of statewide land use, water use, and estimates of future implementation of resource management strategies. Potential beneficiaries of Water PIE include urban water management plans, agricultural water management plans, groundwater management plans, IRWM plans and the CWP.	<ul style="list-style-type: none"> A. Develop project charter. B. Develop business requirements for Water PIE. C. Complete Pilot Project for Water PIE. D. Inventory of existing water data for California. 	DWR	Partially Funded	
10.10 Support establishment of an open, organized, and documented quantitative representation of the State's intertidal water system to serve as a common and standardized data platform for model development and analysis by federal, State, tribal, regional, and local water planners.	<ul style="list-style-type: none"> A. Develop project charter. B. Inventory of existing analytical tools and water data for California. 	DWR or research collaborative	Partially Funded	
10.11 Implement Shared Vision Planning or similar collaborative modeling approaches to integrate tried-and-true planning principles, systems modeling, and collaboration into a practical forum for making more informed and durable water resources management decisions.	<ul style="list-style-type: none"> A. Develop project charter. B. Develop facilitation plan. 	DWR	Partially Funded	

Table 8-11 Related Actions and Performance Measures for Objective 11 (Invest in Water Technology and Science)

Related Actions	Performance Measures	Lead Entities	Funding Status	Legislation Required (X for Yes)
11.1 Advance new water technology to improve Data Management and Modeling by implementing the following:	A. Status of development and implementation strategy.	Resources Agency & CalEPA , Health and Human Services, Public Utilities Commission, Energy Commission, Bureau of Reclamation, USEPA and other stakeholders.	All partially funded, except 11.1.2 is unfunded	Yes, for all sub-actions
11.1.1 Development and implementation of a standardized protocol for water use and quality measurement and reporting strategy and implementation plan necessary for sustainable California water planning and management.	B. Status of development and compliance with protocol.			
11.1.2 Development and compliance of protocol for distributed data storage and use policy with all database managers and with all data linked to the appropriate metadata.	C. Status of development of database portal.			
11.1.3 Development of effective interactive database portals, such as Water PIE (DWR) and HOBBS (UC Davis), should continue with a high priority.	D. Degree of support for monitoring of model protocols.			
11.1.4 Support for the maintenance of current modeling protocols and standards that provide guidance to water stakeholders and decision-makers, and their technical staff, as models are developed and used to solve California's water and environmental problems. The California Water and Modeling Forum should continue to have a major role in this important effort.				
11.2 Advance new water technology to improve both in situ (on-site) and remote sensing for data acquisition by implementing the following:	A. Availability of translation software.	Resources Agency, CalEPA, DWR, Governor's Office (GoBiz), NOAA, NASA, DOE Labs & University Research	All unfunded, except 11.2.8 & 11.2.9 are partially funded.	Yes, for 11.2.4
11.2.1 Developing closer coordination between in situ sensing and remote sensing.	B. Numbers of technology fairs held.Means of effectively transfer technology that does not orphan important technology is in use.			
11.2.2 Supporting technology fairs and/or other effective venues for presenting licensing opportunities for technology developed by the National Laboratories and other government agencies with technology development focused on the water environment.	C. Number of landbased radar systems deployed.			
11.2.3 Increasing the deployment of land based radar where local topographic features prevent adequate weather forecasting.	D. Status of development of protocol.			
<i>In situ (on-site) Data Acquisition:</i> Priorities for in situ data acquisition technology research include:	E. Status of development of sensors.			
11.2.4 Development is required of protocol for data acquisition and compatibility of associated equipment.	F. Development of remote sensing capability for freshwater			

Related Actions	Performance Measures	Lead Entities	Funding Status	Legislation Required (X for Yes)
11.2.5 Development of cost effective sensors.	chemical and physical parameters.			
<i>Remote Sensing Data Acquisition:</i> Priorities for remote sensing data acquisition technology research include:				
11.2.6 Development and use of remote sensors capable of accurately determining qualitatively quantitatively more chemical and physical parameters for fresh water bodies.	G. Number of inexpensive local remote sensors in use.			
11.2.7 Development of inexpensive, local remote sensors to replace or complement <i>in situ</i> sensors for the purpose of providing monitoring capability that is less susceptible to vandalism.	H. Number of drones routinely used.			
11.2.8 Continue the development of utilizing airborne drones to provide targeted data to complement satellite data (e.g., snowpack, reservoir level).	I. Number of public/private partnerships.			
11.2.9 Increased partnerships between the National Aeronautics and Space Administration (NASA), state and private sectors to enhance existing resources while realizing savings by reducing duplicative monitoring and/or increasing required data acquisition opportunities.				
11.3 Advance new water technology to improve efficiencies for the Water-Energy Nexus by implementing the following:	A. Percentage of connections with automatic and advanced metering technology installed.	DWR, PUC, CEC, SWRCB, CDPH	All Unfunded	Yes, for 11.3.1, 11.3.2 & 11.3.3
11.3.1 Smart grid technologies for water and energy conservation and management.	B. Percent of energy for water uses from renewable sources in 2020.			
11.3.2 Use of renewable energy for water treatment and transport processes.	C. Percent of organic residual treatment processes providing bioenergy in 10 years.			
11.3.3 Developing anaerobic processes to facilitate energy recovery from supply and wastewater organic residuals.	D. Level of self monitoring incorporated into POU and POE devices			
11.3.4 Improve technology for residential use of point-of-use (POU) and point-of-entry (POE) treatment.				
11.4 Advance new water technology to improve Membrane Water Treatment by implementing the following:	A. Number of cost effective low energy use membranes developed and in use.	DWR, SWRCB, CEC, CDPH	All partially funded, except 11.4.5 is unfunded.	Yes, for 11.4.5
11.4.1 Further development of more robust, cost- and energy- efficient, general-purpose membranes for use in seawater desalination, brackish water treatment, and wastewater and water reuse applications, with removal of contaminants not now efficiently removed (e.g., boron, contaminants of emerging concern), and	B. Number of high pressure RO applications fitted with energy recovery devices			
	C. Level of advancement of			

Related Actions	Performance Measures	Lead Entities	Funding Status	Legislation Required (X for Yes)
recovery of beneficial salts and minerals for reuse.	remotely controlled small water treatment units			
11.4.2 Further development of energy recovery technologies, particularly for high-pressure reverse osmosis units (e.g., operational pressure as high as 1,180 pounds per square inch gauge [psig], or 8 megapascals [MPa]) but also with application to separation technologies operating at lower pressures.	D. Level of advancement of membrane separation technology in remote communities.			
11.4.3 Further development of smart control technology that ensures more dependable operation of treatment facilities including remotely located treatment facilities (distributed treatment).	E. Level of deployment of brine disposal technologies.			
11.4.4 Development of membrane separation technologies capable of reliable and economic deployment to remotely located communities (distributed treatment).				
11.4.5 Significantly broadened deployment of brine disposal technologies for disposal into marine environments already used outside of California.				
11.5 Advance new water technology to improve Biological Water Treatment by implementing the following:	A. Number of wastewater cleanup technologies developed and deployed.	SWRCB, CDPH, DWR	All unfunded, except 11.5.4 is partially funded.	
11.5.1 Development and deployment of technologies focused on wastewater cleanup for recycling process and wastewater, including use as drinking water (i.e., drinking water, irrigation, process water, groundwater recharge).	B. Number of new innovative sites using engineered wetlands and meadows for wastewater treatment.			
11.5.2 Development of technologies to reduce chemical use and increase energy efficiency, such as engineered wetlands for wastewater treatment and ecosystem enhancement.	C. Number of biological based water and wastewater treatment units deployed in small communities.			
11.5.3 Technology development to support the increased use of affordable distributed biological water and wastewater treatment systems for small, rural communities.	D. Number of small water treatment units being operated remotely using smart control technology.			
11.5.4 Development of better control technology for biological treatment, similar to the earlier stated research priority for membrane separation technology.				
11.6 Advance new water technology to improve watershed management by implementing the following:	A. Status of development of modeling software and major models.	DWR, SWRCB, Resources Agency, CalEPA &	All unfunded, except 11.6.2 is partially	Yes, for 11.6.3
11.6.1 Software development that leads to more effective combining and utilizing of applicable models, in recognition of the need for the effective management of the multiple factors affecting	B. Status of improved surface and groundwater data collection.			

Related Actions	Performance Measures	Lead Entities	Funding Status	Legislation Required (X for Yes)
watersheds, including climate change impacts.	C. Number of groundwater recharge sites developed and implemented.	Applicable Federal Agencies	funded.	
11.6.2 Improved data collection for surface-water and groundwater basin descriptive parameters, including water runoff and storage as a function of time throughout the basin by more extensive use of satellite monitoring, where applicable, and partnering with other agencies (i.e., DWR, SWRCB, US Geological Survey, and others) where possible.				
11.6.3 Expanded use of flood plains and other sites having good recharge potential for groundwater recharge.				
11.7 Advance new water technology to improve Agricultural Water Use Efficiency by implementing the following:	A. The level of adoption of cost effective water measurement and soil moisture sensing technology.	DWR, CDFA	All unfunded	Yes, for 11.7.1 and 11.7.7
11.7.1 Increase the adoption of field level water measurement (flow and total) and soil moisture-sensing technologies to increase water management accuracy and data.	B. The percentage of high efficiency irrigation systems in use.			
11.7.2 Promote the use of high-efficiency water irrigation systems, provide necessary maintenance, and utilize proper irrigation scheduling methods to optimize water- and energy-use efficiency.	C. The level of adoption of advanced technologies for irrigation scheduling			
11.7.3 Increased adoption of one or more technologies for irrigation scheduling (e.g., including remote sensing, weather based, and/or crop/soil-based technologies).	D. The level of development of irrigation performance monitoring platforms.			
11.7.4 Development of cost-effective irrigation system performance information monitoring platforms for evaluating irrigation performance criteria in real time.	E. The percentage of water districts that supply water based on customer demand.			
11.7.5 Increase the number of water districts that provide water deliveries on a demand basis to maximize on-farm water use efficiency.	F. The number of acres or volume of water that provides a local environmental co benefit.			
11.7.6 Use agricultural water and land whenever appropriate to provide local environmental benefits (e.g., flooded rice ground to provide seasonal wetlands for migratory birds and reproduction habitat for fish and aquatic life).	G. The number of transfers or the volume of water transferred between water suppliers or water users.			
11.7.7 Identification of shared use opportunities for water supplies (e.g., water exchanges between agricultural and urban users).	H. Identification and testing of performance monitoring			

Related Actions	Performance Measures platforms	Lead Entities	Funding Status	Legislation Required (X for Yes)
<p>11.8 Advance new water technology to improve Urban Water Use Efficiency by implementing the following:</p> <p>11.8.1 Metering infrastructure to promote more efficient water use (e.g., individual apartments, remote access to water use data).</p> <p>11.8.2 Continued advancement of plumbing code and efficiency standards for low-flow appliances and fixtures, such as toilets and clothes and dish washers in the home and low-flow cleaning technologies in the commercial and industrial sectors.</p> <p>11.8.3 Increased use of American Water Works Association water-loss software and verification program.</p> <p>11.8.4 Greater use of low-water-use landscaping.</p>	<p>A. Percentage of water connections using advanced metering and submetering technology</p> <p>B. Level of implementation of efficient plumbing code and appliance water standards</p> <p>C. The percentage of water districts implementing water loss analysis and repair programs.</p> <p>D. Percentage of low water use landscapes.</p>	DWR, PUC, CEC, SWRCB, CDPH, CDFA	All unfunded, except 11.8.2 is partially funded.	Yes, for 11.8.1 & 11.8.4

Table 8-12 Related Actions and Performance Measures for Objective 12 (Improve Tribal/State Relations and Natural Resources Management)

Related Actions	Performance Measures	Lead Entities	Funding Status	Legislation Required (X for Yes)
<p>12.1 The State, in collaboration with California Native American Tribes, should, where it is within the State's authority, address tribal water rights, including tribal water rights dating back to time immemorial; federally reserved water rights; jurisdiction; and trust responsibilities, including individual allotments, by:</p> <p>12.1.1 Convening a task force to articulate a consistent State policy and protocol that recognizes tribal water rights in all aspects of water planning, including supply, timing, flows, quality, and quantity.</p> <p>12.1.2 Bureau of Indian Affairs and SWRCB, in collaboration with California Native American Tribes, developing joint training on State, federal, and tribal water rights, including trust responsibilities, the implications for different tribal trust lands (reservations, Rancherias, and individual allotments) and jurisdiction.</p>	<p>A. Convene a task force.</p> <p>B. Develop and provide initial training class.</p>	Tribes, Bureau of Indian Affairs, SWRCB		
12.2 State government should write legislation and contracts in a way that enables California Native American Tribes to be a lead agency and directly receive and manage state funding (as fiscal agent or otherwise) for water planning and management.	<p>A. Development of appropriate language by tribes.</p> <p>B. Language incorporated into future water bonds.</p> <p>C. Language incorporated into groundwater basin plans.</p>	Tribes, State Agencies (DWR, CDPH, HHS, SWRCB) responsible for capacity development		X
12.3 DFW and California Native American Tribes will develop and initiate pilot projects to develop resource management plans, characterized by the integration of Traditional/Tribal Ecological Knowledge and western science. This will include identifying existing examples of partnerships and launching pilot projects.	Development and initiation of pilot project(s).	Tribes, DFW		
12.4 State agencies should use Tribal Ecological Knowledge to inform their work and decisions, including establishing baseline resource conditions and developing options to share information in ways that protect specific details about cultural resources.	<p>A. State agencies begin working with tribes to develop a strategy to integrate TEK.</p> <p>B. Number of State agencies that</p>	State Agencies (DWR, SWRCB, DFW, DOC,		

Related Actions	Performance Measures	Lead Entities	Funding Status	Legislation Required (X for Yes)
	consider TEK in their decision-making process.	Parks & Recreation)		
	C. Number of adopted State agency strategies and policies that include TEK.			
12.5 State agencies, in collaboration with California Native American Tribes, should develop and conduct trainings for agencies on tribal sovereignty, trust responsibilities, cultural awareness/sensitivity, and Traditional/Tribal Ecological Knowledge by developing a curriculum with a tribal working group, establishing consistent training protocols for all agencies, and initiating trainings.	A. Identify responsible tribes and State agencies to assist in curriculum development. B. Develop curriculum and consistent training protocols. C. Convene pilot training.	Tribes, State Agencies (Parks & Recreation, SWRCB, DWR, DFW, DOC, etc.)		
12.6 State and federal agencies, in coordination with California Native American Tribes, should identify, coordinate, and provide technical training for California Native American Tribes, to increase technical capacity — including, but not limited to, basic training modules (e.g., Basic Inspector Academy, GIS, small water systems operations, such advanced technologies as LiDAR and satellite imagery) — and establish criteria and protocols for ensuring training vendors preferred by California Native American Tribes are utilized.	A. Level of coordination between State and federal agencies and tribes. B. Identify the type of technical training needed. C. Convene pilot training. D. Development of criteria and process to identify list of Tribal preferred vendors.	Tribes, State agencies, Federal agencies (USGS)	Unfunded	
12.7 State agencies should engage tribal communities in compiling and developing climate change adaptation and resilience strategies that will mitigate climate impacts to their people, waterways, cultural resources, or lands.	A. Level of engagement between State agencies and tribes. B. Number of tribes providing climate change data to the State. C. Development of adaptation and mitigation strategies for Tribal lands.	Tribes, State agencies	Partially Funded	
12.8 The SWRCB should, in collaboration with California Native American Tribes, propose a statewide beneficial use definition that respects and acknowledges cultural and subsistence use of water and this definition should be adopted in	Development and adoption of new beneficial use definition that respects and acknowledges cultural and	SWRCB, Tribal Workgroup		

Related Actions	Performance Measures	Lead Entities	Funding Status	Legislation Required (X for Yes)
statewide water quality control plans.	subsistence use of water.			
12.9 State agencies and California Native American Tribes should utilize and implement communication strategies, protocols, and procedures that are developed and/or implemented by California Native American Tribes, including but not limited to the Tribal Communication Plan, U.N. Declaration on the Rights of Indigenous Peoples, 2013 Tribal Water Summit Guiding Principles and Goals, and tribal memoranda of understanding.	Number of state agencies that develop tribal communication plans.	Tribes, State agencies		
12.10 State agencies, in collaboration with California Native American Tribes, should enhance tribal outreach, communication, coordination, collaboration and the work of tribal liaisons by identifying and implementing strategies to strengthen tribal involvement in State outreach and engagement approaches; clarify tribal liaison roles and responsibilities; and identify options for creating a statewide network of tribal liaisons to address multiple aspects of tribal concerns (e.g., legal, policy, and local conditions).	Number of statewide tribal liaisons created.	Tribes, Governor's Office of the Tribal Advisor		
12.11 State agencies should engage in meaningful consultation by encouraging and moving toward earlier involvement by California Native American Tribes (at the design/planning stages); initiating consultation for programmatic decisions as well as project-level decisions; understanding individual California Native American Tribes' protocol for consultation, adjusting timelines to allow adequate time to bring items before tribal councils and leaders; conducting meetings on tribal lands; and documenting tribal comments.	Development and implementation of consultation policy by State agencies.	Tribes, State agencies		

Table 8-13 Related Actions and Performance Measures for Objective 13 (Ensure Equitable Distribution of Benefits)

Related Actions		Performance Measures	Responsible / Lead Entity	Funding Status (Full, Partial, or Unfunded)	Legislation Required (X for Yes)
13.1	Ensure implementation of the policy goals of California Water Code Section 106.3, (AB 685) which state that every human being has the right to safe, clean, affordable, and accessible water adequate for human consumption, cooking, and sanitary purposes.				
13.1.1	State government should ensure that the goals established by the policy — safe, clean, affordable, and accessible water adequate for domestic uses — are reflected in agency planning.				
13.1.2	State government should give preference to policies that advance the policy and refrain from taking actions that adversely affect the human right to water.				
13.1.3	State government should report on actions undertaken to promote the policy and make information relevant to the human right to water available to the public.				
13.1.4	State government should foster meaningful opportunities for public participation in agency decision-making by California's diverse population.				
13.1.5	State government should facilitate access by rural and urban DACs to state funds for water infrastructure improvements.				
13.1.6	State government should ensure the effectiveness of accountability mechanisms protecting access to clean and affordable water.				
13.2	Develop CWP goals and objectives, in coordination with IRWM partnerships, to resolve water-related public health issues in DACs.				
13.2.1	California tribes, both recognized and unrecognized, should provide goals and objectives to protect tribal uses of water, especially those that affect the health of tribal members (see Objective 12).				

Related Actions	Performance Measures	Responsible / Lead Entity	Funding Status (Full, Partial, or Unfunded)	Legislation Required (X for Yes)
13.2.2 DWR, DFW, and other State agencies should develop statewide goals and objectives for the provision of safe fish for communities that rely on fish as part of their subsistence diet.				
13.2.3 DWR, in consultation with other State agencies, including the Department of Conservation, tribes, and community groups, should develop goals and objectives to restore and protect watersheds by making use of existing community-based watershed councils and groups under-utilized in maintaining and restoring California's water resources.				
13.3 Support financial mechanisms to facilitate improved wastewater removal systems.				
13.3.1 The SWRCB and DWR should establish incentives to support conversion to municipal or other upgraded wastewater removal systems.				
13.3.2 The SWRCB and DWR should establish a process to create introductory, then graduated, wastewater rates to allow a period of adjustment for new fees.				
13.4 Increase disadvantaged community access to funding.				
13.4.1 The SWRCB, CDPH, DWR and other State agencies should work with DACs and vulnerable populations and their advocates to review State government funding programs and develop guidelines that make funding programs equally accessible to DAC and EJ communities.				
13.4.2 The SWRCB, CDPH, DWR and other State agencies should work with disadvantaged communities and vulnerable populations and their advocates to develop a technical assistance program to provide resources, expertise, and information to disadvantaged and environmental justice communities to enable them to actively and equally participate in planning processes and access funding sources.				

Related Actions	Performance Measures	Responsible / Lead Entity	Funding Status (Full, Partial, or Unfunded)	Legislation Required (X for Yes)
13.5 Provide incentives for the consolidation, acquisition or improved management of small water systems.				
13.5.1 CDPH should establish incentives to encourage consolidation with the “smalls” by the larger system. There are valid concerns on the part of the larger system when approached with the idea of acquiring small, dysfunctional systems.				
13.5.2 CDPH should conduct outreach and education for customers and shareholders to a proposed consolidation to ensure informed decision-making.				
13.5.3 CDPH should support efforts to improve licensing and training options for small water system operators.				
13.6 CDPH should implement its Small Water System Program Plan to assist small water systems (especially those serving DACs) that are unable to provide water that meets primary drinking water standards.				
13.6.1 CDPH should share the Small Water System Program Plan with relevant federal, State, and local agencies, as well as stakeholders, to foster additional opportunities for funding, coordinate construction projects in communities, and assist in local and regional planning efforts.				
13.6.2 CDPH should utilize GIS tools to identify large water systems in close proximity to targeted small water systems, and conduct targeted outreach to these large water systems to encourage them to consolidate the small systems into their service area.				
13.6.3 CDPH should work with stakeholders to identify obstacles to consolidation (including financial, legal and local issues) and develop possible actions to address these obstacles.				
13.6.4 CDPH should participate in statewide planning efforts to address the water infrastructure needs of small water systems. CDPH should seek input from other states and the federal government on innovative,				

Related Actions	Performance Measures	Responsible / Lead Entity	Funding Status (Full, Partial, or Unfunded)	Legislation Required (X for Yes)
successful efforts to address the needs of small water systems, and should share its results on implementation of its Small Water System Program Plan.				
<p>13.7 Collect and maintain data on EJ communities and DACs</p> <p>13.7.1 The SWRCB, CDPH, DWR, and other State and federal agencies should coordinate their review of current monitoring and regulatory programs to identify and address gaps in available data and monitoring programs that affect DACs and vulnerable populations.</p>				

Table 8-14 Related Actions and Performance Measures for Objective 14 (Protect and Enhance Public Access to the State's Waterways, Lakes, and Beaches)

Related Actions		Performance Measures	Lead Entities	Funding Status	Legislation Required (X for Yes)
14.1	Respect and Protect. State government will respect and vigorously protect waterways, lakes, and beaches for beneficial public use.	A. By July 1, 2015, and annually thereafter, State agencies should report on successful efforts to protect beneficial public use, and barriers to fully meeting these responsibilities.	CCC, BCDC, SWRCB, SLC, CDFW, State Conservancies.	A. ?	
14.1.1	The State will support the regulatory responsibilities of the California Coastal Commission (beach access), Bay Conservation and Development Commission (San Francisco estuary access), SWRCB (water quality and supply), State Lands Commission (navigation), DFW (inland fisheries), and others that protect beneficial uses such as fishing, boating, and other public access rights.	B. By July 1, 2015, the State Lands Commission, collaborating with other agencies, should provide an online searchable database of legal public access locations to waterways, lakes and beaches.		B. ?	
14.1.2	State conservancies — such as the Sacramento-San Joaquin Delta Conservancy, Tahoe Conservancy, and Sierra Nevada Conservancy — should acquire and/or protect sensitive landscapes, such as key watershed lands and wetlands, flood conveyance zones, riparian woodlands, and vernal pools with important natural resource and scenic values, and significant beneficial public uses. The conservancies, including the State Coastal Conservancy, should protect and/or acquire land to maintain public access to waterways, lakes, and beaches.	C. By July 1, 2015, State conservancies should collaborate on land acquisition priorities and climate change adaptation and mitigation strategies.		C. ?	
14.1.3	The State should protect recreational resource values threatened by the effects of climate change by using strategies of reinforcement, adaption, and/or retreat as feasible.				
14.1.4	As water resources are developed, flood control facilities are envisioned, and sea level rise is accommodated, State government, including, but not limited to, DWR and the California Department of Transportation, will protect and minimize impacts on cultural and recreational uses.				
14.2	Research and Planning. State government should engage in statewide research and planning to meet California's unmet and growing demand for safe public access to waterways, lakes, and beaches.	A. Every 5 years, CSP and DWR should report on statewide water-dependent recreation trends and demand.	CSP, DWR, SCC,BCD C	All partially funded, except PM "B" is fully funded, and PM "D" is unfunded.	
14.2.1	State government, such as the California Department of Parks and Recreation (California State Parks) and DWR, should document and regularly report on the water-dependent recreational trends of California's growing population, the public health and economic benefits of recreational activities, and threats to the tourism and lifestyle benefits of California's water-dependent recreational infrastructure.	B. Annually, beginning July 1, 2014, DWR should report on all State agency expenditures to provide the SWP's public benefits, as well as the source of those funds.			
14.2.2	State government, such as DWR, will report on the feasibility of incorporating public access facilities into each water resources development and flood management infrastructure project, watershed	C. By July 1, 2014, DWR should establish a state, federal and			

Related Actions	Performance Measures	Lead Entities	Funding Status	Legislation Required (X for Yes)
<p>protection efforts, and environmental restoration projects funded by the State and federal governments. Consider multi-benefit projects that increase waterfront accessibility, create more inclusive access opportunities, support commercial and recreational fishing, encourage economic revitalization, promote excellence and innovation in urban design, enhance cultural and historic resources, and are resilient to a changing climate. Plan to include, where feasible, levee crown widening in levee improvement projects to accommodate multi-purpose recreational trails and bike lanes.</p> <p>14.2.3 State conservancies, such as the State Coastal Conservancy, Bay Conservation and Development Commission, and California State Parks should collaborate with local agencies to systematically plan to reinforce, adapt, and/or relocate recreational opportunities threatened by sea level rise and transportation or wastewater infrastructure adaptations.</p> <p>14.2.4 California State Parks should lead comprehensive recreation resource planning of the state's inland waterways, engaging the public, recreation providers, policy-makers, advocacy groups, and public officials. Consider facilities that provide opportunities for the top outdoor recreation activities identified in the <i>Survey of Public Opinions and Attitudes on Outdoor Recreation in California</i>, especially those benefiting disadvantaged communities.</p>	<p>local agency Proposed Water Project Recreation Coordinating Committee to meet at least quarterly, to provide guidance on incorporating public access facilities in new projects.</p> <p>D. By July 1, 2014, DPC and SSJDC should establish a multi-agency Delta and Suisun Marsh Recreation and Tourism Coordinating Committee to provide guidance on enhancing water-dependent recreation.</p> <p>E. By July 1, 2016, SCC and BCDC should prepare a comprehensive report on SLR threats to existing public access, with potential management actions.</p> <p>F. By July 1, 2016, CSP should prepare a public access plan for navigable inland waterways.</p>	DWR, CSP, Conservancies	All partially funded, except PM "D" is unfunded.	
<p>14.3 Enhance. All State agencies with public access responsibilities should, in concert with local agencies, enhance safe public access by providing water-dependent recreational facilities and programs that support beneficial uses, and/or improve the social and economic sustainability of federally funded and State-funded infrastructure, watershed protection, and environmental restoration projects.</p>	<p>A. By July 1, 2016, state agencies should update State grant criteria to fund public access enhancement in watershed protection, flood management and water resources development projects unless demonstrated infeasible.</p>			
<p>14.3.1 State government, including DWR, California State Parks, and all state conservancies, should facilitate and/or construct water-dependent recreation projects that spur the economic development of disadvantaged communities, provide environmental stewardship benefits, enhance natural resource values, protect or relocate existing recreational opportunities, and meet the regional demand for healthy outdoor recreation opportunities for all Californians, especially children.</p>	<p>B. By July 1, 2015, DWR will secure adequate, on-going funding to provide SWP public access facilities commensurate with demonstrated demand.</p>			
<p>14.3.2 The Delta Protection Commission and Sacramento-San Joaquin Delta</p>	<p>C. Annually, beginning July 1,</p>			

Related Actions	Performance Measures	Lead Entities	Funding Status	Legislation Required (X for Yes)
<p>Conservancy should encourage partnerships between other State and local agencies, local landowners, and business people to expand water-dependent recreation and tourism in the Delta and Suisun Marsh, while minimizing adverse impacts on non-recreational landowners. Use California State Parks' <i>Recreation Proposal for the Sacramento-San Joaquin Delta and Suisun Marsh</i> and the Delta Protection Commission's <i>Economic Sustainability Plan</i> as guides.</p>	<p>2015, CSP should report on the location of all new waterfront public access facilities constructed with State funds.</p> <p>D. By July 1, 2017, state agencies should apply for at least six National Water Trail program designations.</p>			
<p>14.3.3 As California's population increases, State government, such as DWR, DFW, and California State Parks, should increase water-dependent recreation opportunities on existing public land, where feasible. State government should also pursue acquisition opportunities that provide open space and public access to water features, such as the ocean, lakes, rivers, streams, and creeks, where demand exceeds supply.</p>				
<p>14.3.4 State agencies should prioritize construction of water-dependent recreation facilities identified in IRWM plans; active-use facilities, such as multi-use trails for equestrians, hikers, walkers, and bikers, which improve public health; boating trails; facilities that mitigate or adapt to climate change; facilities that increase the safety of anglers, swimmers, and boaters; and facilities that provide environmental education, such as water conservation and water quality information.</p>				
<p>14.4 Promote. All State agencies with waterfront public access responsibilities should cooperate with local agencies, businesses, and the general public to promote healthy outdoor recreation, resource-based tourism, and environmental stewardship to benefit public health and welfare, improve the environment, and grow the economy commensurate with protection of public property rights.</p>	<p>A. By July 1, 2015, the SNC should develop and implement a Sierra Nevada Sustainable Tourism and Recreation Strategy to promote sustainable water-dependent recreation.</p>	<p>SNC, CSP, State agencies</p>	<p>All unfunded</p>	
<p>14.4.1 All state conservancies, DWR, DFW, and California State Parks should improve outreach and education to children and in disadvantaged communities that will improve public health, support California's outdoor lifestyle, and promote wise use of water resources.</p>	<p>B. By July 1, 2015, California State Parks should convene a state agency task force to develop an education and outreach campaign to promote water-dependent recreation state-wide. The task force should recommend public-private partnership funding mechanisms to implement the campaign.</p>			

Related Actions	Performance Measures	Lead Entities	Funding Status	Legislation Required (X for Yes)
	C. By July 1, 2016, State agencies should implement the education and outreach campaign to promote water-dependent recreation state-wide.			

Table 8-15 Related Actions and Performance Measures for Objective 15 (Strengthen Alignment of Land Use Planning and Integrated Water Management)

Related Actions		Performance Measures	Lead Entities	Funding Status	Legislation Required (X for Yes)
15.1	State Government should provide additional regulatory and financial incentives to developers and local governments to plan and build using compact and sustainable development patterns.	A. Inventory state regulatory and financial incentives to develop base data for future assessment of enhanced incentives.	OPR	Partial	
15.1.1	Regulatory incentives include further streamlining of CEQA review for infill projects and further reductions in brownfields liability for innocent purchasers.	B. Number of expanded or new regulatory and financial incentives.			
15.1.2	Financial incentives include developing criteria for state grant and funding programs that incentivize compact and sustainable development.				
15.2	The OPR should provide guidance and financial incentives for integration of IWM issues in general plan updates and Sustainable Communities Strategy (SCS), including both substantive and planning process guidance.	State issuance of guidance and financial incentives.	OPR	Unfunded	
15.3	Local governments should integrate relevant IWM issues into their general plan updates. IWM issues relevant to land use planning include water supply, water quality, flood risk management, and climate policies (mitigation and adaptation).	Number of General Plan updates with effective integration of IWM issues. "Effective integration" means substantial treatment of IWM issues, either in existing General Plan elements or a new optional Water Element.	Local governments	Partial	
15.4	The Strategic Growth Council should provide guidance and financial incentives for regional planning agency integration of relevant IWM issues into SCSs, transportation blueprint plans, and other regional plans.	State issuance of guidance and financial incentives.	Strategic Growth Council	Partial	
15.5	Regional planning agencies should integrate IWM issues into their SCSs, transportation blueprint plans, and other regional plans.	Percent of (or Number) of regional planning agencies meaningfully integrating IWM issues in their regional plans.	Metropolitan Transportation Organizations (MPOs) and Councils of Government (COGs)	Unfunded	

Related Actions	Performance Measures	Lead Entities	Funding Status	Legislation Required (X for Yes)
15.6 Local governments should ensure that urban water management plans inform and reflect IRWM plan preparation and implementation, to further IWM integration in local land-use planning that promotes compact and sustainable development.	Number of UWMPs reflecting IRWMPs effective integration of local land use planning for compact and sustainable development.	Local Governments	Partial	
15.7 Local governments should implement specific land-use planning and regulatory measures to reduce flood risks, consistent with IWM principles and BMPs for land use planning.	Number of General Plan updates and local flood management regulations with meaningful policies to reduce flood risks, consistent with IWM principles and DWR best practices.	Local Governments	Partial	
15.7.1 Measures include preservation of existing floodplains, aquifer recharge areas, and alluvial fans; restoration of natural floodplain functions; and design measures to increase post-flood resiliency. See Objective 6, Related Action 6.8 regarding the process for developing land use planning BMPs.				
15.8 DWR should assist local governments and developers with implementing the <i>Integrating Water and Land Management: A Suburban Case Study and User-Friendly, Locally Adaptable Tool</i> , which calculates life-cycle water infrastructure costs for different development patterns.	Number of local governments and developers using the Tool in their planning decisions.	DWR	Partial	
15.9 State government should evaluate the effectiveness of the 2007 flood management legislation in achieving coordination of land use planning, flood planning, and natural resources. State government should recommend changes to existing laws and their implementation to increase their effectiveness as appropriate.	Issuance of report evaluating effectiveness of 2007 flood legislation.	DWR	Unfunded	X
15.10 State government should evaluate the effectiveness of SB 610 and SB 221 in achieving coordination of land use and water supply planning. State government should and recommend changes to existing laws and their implementation to increase their effectiveness in achieving objectives, as appropriate.	Issuance of report evaluating effectiveness of SB 610 and SB 221.	DWR	Unfunded	X
15.11 State government should invest in innovation and technology for assessment of land use, water supply, and flood conditions to further integrate water management and land use.	Number innovations in technology for land use and integrated water management.	DWR	Partial	
15.11.1 The State should provide funding, technical information, and BMPs, and publicize accurate and relevant water resources information for use by local governments and developers. The State could serve as an information clearinghouse for regional				

Related Actions	Performance Measures	Lead Entities	Funding Status	Legislation Required (X for Yes)
water supply, water quality, flood management, and climate change vulnerability information that local governments can use in preparing general plans and evaluating development applications.				

Table 8-16 Related Actions and Performance Measures for Objective 16 (Strengthen Alignment of Government Processes and Tools)

Related Actions	Performance Measures	Lead Entities	Funding Status	Legislation Required (X for Yes)
16.1 To advance IWM, federal, State, tribal, and local government agencies should strengthen alignment among their data, plans, programs, policies, and regulations. More specifically, they should:				
16.1.1 Collaborate to develop consistent policies for advancing IWM at a regional scale, and use a broad and diverse mix of administrative tools to implement their policies, including technical assistance and data support; financial incentives; and State funding, guidelines, and regulations.	A. State agency policy statements for strengthening alignment B. Agency list of administrative tools being used C. Participation on CBC Interagency Alignment Team	Water Plan State Agency Steering Committee	n/a	No
16.1.2 Adopt the “Strengthening Agency Alignment for Natural Resource Conservation” resolution (April 2013) vision, goals and principles, developed with extensive input from 42 federal and State agencies, including multiple Water Plan State Agency Steering Committee members, among others.				
16.1.3 Utilize the best practices and tools recommended in the “Strengthening Agency Alignment for Natural Resource Conservation” resolution.				
16.1.4 Participate on the Biodiversity Council's Interagency Alignment Team.				
16.2 State government should more effectively coordinate the work of multi-agency collaboratives, and utilize them to align and implement State water policies and promote IWM. This should include developing and maintaining a shared and easily accessible interagency inventory/repository of processes and tools for strengthening government agency alignment. Examples of multi-agency collaborative include, but are not limited to, the Strategic Growth Council, California Biodiversity Council, Delta Stewardship Council, Ocean Protection Council, Water Plan State Agency Steering Committee, Conservancies and Resource Conservation Districts, California Council on Science & Technology, and California Landscape Conservation Cooperative.	A. State government water planning calendar B. Inventory of companion State and federal plans C. Inventory of State water data collection programs and databases D. Inventory of water-related collaboration venues and public processes E. Inventory of water-related State Listserves and electronic newsletters, etc.	California Biodiversity Council's Interagency Alignment Team	n/a	No
16.3 State government agencies should hire, assign, or train staff with collaboration and conflict resolution knowledge, skills, and abilities (KSA), whose primary job is to work with other federal, State, tribal, regional, and	A. Standard collaboration and conflict resolution KSA language for duty statements	Cal-HR	n/a	No

Related Actions	Performance Measures	Lead Entities	Funding Status	Legislation Required (X for Yes)
local agencies, organizations, and communities to improve interagency communication, cooperation, collaboration, and alignment.	B. Agency hires with standard collaboration and conflict resolution KSAs			
16.3.1 California Department of Human Resources (Cal-HR) should convene an interagency working group to develop standard language describing collaboration and conflict resolution KSAs for use in duty statements where this core competency is a minimum qualification.	C. Collaboration and conflict resolution training class curricula			
16.3.2 State agencies should include this standard KSA language in duty statements for staff and management classifications to promote State agency collaboration and alignment, and they should require incumbents in these classifications to complete facilitation training.	D. Number of Training class participants			
16.4 Federal and State government agencies should use a more inclusive, collaborative, and outcome-based approach for setting consistent and aligned water policies and regulations that are regionally appropriate. More specifically, they should:	A. Examples of outcome-based regulations	Water Plan	Partial – additional	No
16.4.1 Recognize regional and local diversity by assisting, enabling, and empowering regional water collaboratives, such as IRWM Regional Water Management Groups and Resource Conservation Districts, to determine <i>how</i> State water policies are implemented in their planning regions and/or watersheds.	B. Examples of performance measures/ indicators	State Agency	funding and staff may be	
16.4.2 Focus on intended and regionally appropriate outcomes (goals and objectives) when setting water policies, regulations, guidelines, and resource management plans for California. Agencies should establish performance measures/indicators to evaluate progress toward achieving desired outcomes, and include an adaptive management approach as a part of regulatory compliance.	C. Examples of regional implementation plans	Steering Committee	needed to work with	
16.4.3 Provide a voluntary program for regional collaboratives, such as IRWM Regional Water Management Groups and Resource Conservation Districts, to develop an implementation and monitoring plan that describes the resource management strategies (actions) the group will implement to achieve the regulations' intended outcomes in their planning regions and/or watersheds, as appropriate for their local conditions and resources.	D. Regional technical assistance survey results		more regional collaboratives	
16.4.4 Utilize voluntary, outcome-based and system-scale (watershed and ecosystem) approaches for regulatory and permitting processes, and engage project proponents collaboratively, earlier and more	E. Project permit process duration		earlier and more often during the regulatory and/or permitting process	

Related Actions	Performance Measures	Lead Entities	Funding Status	Legislation Required (X for Yes)
often during the process.				
16.4.5 DWR and other State agencies should survey regional collaboratives, such as IRWM Regional Water Management Groups, to determine what technical assistance they need to facilitate collaboration and support change in regulatory approaches.				
16.5 The State should convene regulatory working groups, in collaboration with federal, tribal, and local governments, to improve and streamline regulatory review and permitting processes for implementing IWM projects more expeditiously. These regulatory working groups should take the following actions in collaboration with regional stakeholders, while recognizing the unique differences among California's geographical regions:	<p>A. Number of regions with working groups and number/ types of environmental permitting processes reviewed, number and type of activities approved under the new processes with historical comparison</p> <p>B. Regional and/or statewide guidance for water quality and ecosystem restoration</p> <p>C. Number of regions and list of regulatory agencies engaging in baseline data sharing</p> <p>D. Number of regions and list of agencies adopting a regional mitigation database and mitigation bank</p> <p>E. Regional permitting guidebooks</p>	Options -- Strategic Growth Council, CBC Interagency Alignment Team, or Water Plan State Agency Steering Committee	Partial – some existing resources may be reallocated; new funding would be required for additional regulatory agency staff	No
16.5.1 Identify critical resource needs of regulatory agencies necessary to adequately implement regulatory programs and proposed regulatory alignment actions to support IWM, including science, tools, data, policy, guidance, and agency personnel.				
16.5.2 Maximize the use of existing mechanisms such as habitat conservation plans and natural community conservation plans.				
16.5.3 Review and streamline permit processes to improve efficiency and reduce costs, delays, inconsistencies, and associated adverse impacts, and develop regional permitting processes for recurrent actions and operation and maintenance activities.				
16.5.4 Develop and adopt region-specific guidance on ecosystem restoration, water quality improvement, and environmental stewardship strategies to expedite review.				
16.5.5 Develop and adopt specific guidance to expedite emergency response and public safety projects for high-risk areas.				
16.5.6 Evaluate and adjust regulatory staff assignments to improve regulatory review and permitting processes at a regional scale, facilitate earlier staff involvement in planning phases for complex projects, and identify resource gaps.				
16.5.7 Compile, maintain, and utilize regional knowledge bases (data, information, and science), including information on endangered species, sensitive habitat, water quality, and other baseline				

Related Actions	Performance Measures	Lead Entities	Funding Status	Legislation Required (X for Yes)
information.				
16.5.8 Develop and maintain regional environmental mitigation databases and mitigation banks to address the varying mitigation requirements among multiple regulatory programs and agencies in each region and across regions.				
16.5.9 Develop a multi-agency permitting guidebook that includes a description of the relevant permits, permit applications, and permitting guidance for common and more routine IWM projects.				

Table 8-17 Related Actions and Performance Measures for Objective 17 (Improve Integrated Water Management Finance Strategy and Investments)

Related Actions	Performance Measures	Lead Entities	Funding Status	Legislation Required (X for Yes)
<p>17.1 Regional and local entities should continue investing in IWM activities based on regional and local conditions, goals, priorities, and solutions.</p> <p>Reliable and effective water finance planning should continue at the regional and local levels in partnership with State government. Locally sponsored initiatives will continue to be a cost-effective approach for planning and implementing IWM innovation and infrastructure (green and grey) to provide multiple benefits to their respective jurisdictions. Regional and local investments should be augmented and amplified with federal and State public funding.</p>	<p>Regional and local expenditures, using: a) investment categories defined in “IWM Activities” section of Chapter 7, and b) data from “Existing Funding (Component 3)” related action.</p> <p>Type and quality of IWM benefits produced, using benefit types defined in “IWM Scope and Outcomes” section of Chapter 7.</p>	<p>Regional Water Management Groups, Cities, Counties, Water and Flood Districts, Resource Conservation Districts</p>	<p>Partial and often unreliable funding</p>	<p>No</p>
<p>17.2 State government should continue to provide incentives for regional IWM (IRWM) activities that achieve State goals or provide broad public benefits.</p> <p>This includes assisting regions technically and financially to implement their IRWM plans and/or help achieve State government goals and interests. State government should continue to enhance incentives for regional activities and invest in infrastructure (green and grey) that provides a public benefit <i>and</i> would not otherwise be cost effective.</p>	<p>A. State government expenditures for regional and local incentives, using investment categories defined in “IWM Activities” section of Chapter 7.</p> <p>B. Type, location, and quantity of IWM benefits produced, using benefit types defined in “IWM Scope and Outcomes” section of Chapter 7.</p>	<p>DWR, SWRCB, DPH</p>	<p>Full — Funded through about 2018, when existing bonds will be fully allocated</p>	<p>Yes — new bond (also requires voter approval), new general fund appropriations, or other</p>
<p>17.3 State government should improve and facilitate access to federal and State public revenue sources.</p>	<p>A. Resource catalog developed and deployed? (Y or N)</p> <p>B. Training and assistance program developed and deployed? (Y or N)</p>	<p>DWR, DPH, SWRCB</p>	<p>Partial</p>	<p>No</p>
<p>17.3.1 State government should develop a central online resource catalog to describe different funding programs, potential IWM revenue sources, and a how-to guide explaining how to apply for funding from these programs.</p>				
<p>17.3.2 State government should provide guidance and assistance to local</p>				

Related Actions	Performance Measures	Lead Entities	Funding Status	Legislation Required (X for Yes)
<p>agencies on how to apply for funding that includes technical and financial assistance, as well as training for regions that do not have the capacity or resources to apply for funding or manage grants.</p> <p>17.3.3 State government should inventory federal funding sources and provide guidance for partnering with, or leveraging, federal funding.</p>				
<p>17.4 The governor and the Legislature should broaden the ability of (and create guidelines and limitations for) public agencies to partner with private agencies, entities, and organizations for IWM investments.</p> <p>New policies are required to overcome the following limitations that have restricted their use:</p> <p>17.4.1 Private financing rates are generally higher due to tax effects. Local bond financing options would typically be tax exempt for the bondholder and therefore have lower interest rates.</p> <p>17.4.2 The prohibition of their use for State government projects restricts public-private partnerships (P3s) to local projects.</p>	<p>New legislation developed? (Y or N)</p>	DWR	Unfunded	Yes
<p>17.5 State government should develop a more reliable, predictable, and diverse mix of finance mechanisms and revenue sources to continue to invest in IWM innovation activities and infrastructure (green and grey) that have broad public benefits, including, but not limited to, General Funds and General Obligation bonds.</p> <p>An important role of State government is to invest in innovation activities having broad public benefits that include improving State water governance, improving water planning and public engagement, investing in infrastructure (green and grey), strengthening government agency alignment, enhancing information technology (data and analytical tools), and advancing the use of water technology and science. These activities should be conducted in collaboration with the ongoing regional and local</p>	<p>A. Magnitude and variability of State funding over time using:</p> <p>i. Historical expenditure methods and (additional) data presented in Update 2013</p> <p>ii. Investment categories defined in "IWM Activities" section of Chapter 7.</p>	Governor and Legislature	Unfunded	Yes — new bond (also requires voter approval), new general fund appropriations

Related Actions	Performance Measures	Lead Entities	Funding Status	Legislation Required (X for Yes)
innovation activities.				
Finance mechanisms used for these IWM innovation activities should:				
A. Improve cost effectiveness, efficiencies, and accountability.				
B. Avoid stranded costs and funding discontinuity.				
C. Leverage funding across State government agencies.				
D. Increase certainty of desired outcomes.				
E. Enable prioritization based on shared funding values, defined principles, goals, objectives, and criteria.				
17.6 State government should reduce planning and implementation time frames and costs associated with IWM activities by clarifying, aligning, and reducing redundancies among State government agencies' policies, incentive programs, and regulations.	A. ROI report card developed? (Y or N) B. New methods for leveraging funding more efficiently and effectively developed (Y or N)?	IWM Finance Alignment Group — DWR, SWRCB, CA Dept. of F&W	Unfunded	Yes, to Implement IWM alignment group recommendations
17.6.1 Develop the scope and methodology and prepare a <i>Return on State Government Investment</i> report card through the CWP update collaborative process (5-year interval) that would track the occurrence of benefits/value derived from State government investments (and leveraged local investments) by using specific criteria and sustainability indicators.				
17.6.2 Convene an interagency IWM finance alignment group that includes State planning, resource management, and regulatory agencies to identify and implement finance policies, procedures, and protocols for the enhancement of State government transparency, accountability, flexibility, and cost efficiencies. This effort would recommend ways to reduce duplication and fragmentation among State government agencies' policies, incentive programs, regulations, and budgets.				
17.7 The California Water Plan Update 2018 process will refine and advance the eight components of the Finance Planning Framework as described in the "Next Steps" section of Chapter 7, "Finance Planning Framework."	A. IWM scope and outcomes discussed and updated (Y or N)? B. Types of IWM activities specified (Y or N)? C. Data identified, acquired, updated (Y or N)?	DWR	Partial — Existing Water Plan Program funding	No

Related Actions	Performance Measures	Lead Entities	Funding Status	Legislation Required (X for Yes)
Future work will cover each component of the Framework in the following ways:	D. Method developed and deployed (Y or N)?		will have to be	
A. IWM Scope and Outcomes (Component 1) — Revisit, clarify, and adapt the scope of IWM to changing conditions and priorities.	E. Description of future role of State government advanced, made more clear or more specific?		redirected from other	
B. IWM Activities (Component 2) — Develop more specificity regarding the types of activities that State government should invest in with a clearer nexus to the types of anticipated benefits.	i. Local and regional survey developed and deployed? ii. Method developed and data collection?		Water Plan activities.	
C. Existing Funding (Component 3) — Continue to compile and synthesize data that tracks historical water-related expenditures across federal, State, and local governments in California.	F. Finance DSS developed?			
D. Funding Reliability (Component 4) — Work with the State Agency Steering Committee to identify where potential funding gaps exist between the State IWM activities described in component 2 and existing funding levels and sources. Collaborate with regional water management groups to do the same for regional and local IWM activities.				
E. State Role and Partnerships (Component 5) — Continue to clarify and elaborate on the future role of State government to support a more specific description and estimate of future costs.				
F. Future Costs (Component 6) — Estimate future funding demands by (a) launching IRWM, city, county, and special district data pull; and (b) work with State Agency Steering Committee to estimate the funding demand for existing and future IWM activities.				
G. Funding, Who and How (Component 7) — Continue to collaborate with stakeholders and federal, State, tribal and local governments to investigate and develop solutions that address the facts and findings detailed in Chapter 7, “Finance Planning Framework.” This work will				

Related Actions	Performance Measures	Lead Entities	Funding Status	Legislation Required (X for Yes)
include, but will not be limited to:				
i. Funding methods that provide a consistent financing framework for State government investments in IWM.				
ii. A prioritization method and rationale for apportioning IWM investment by the categories and subcategories developed in the Update 2013 Finance Planning Framework (i.e., Innovation, Infrastructure).				
iii. Methods for enhancing stewardship of State government monies at both statewide and regional scales, including strategies to improve the transparency and accountability of State fund disbursements.				
iv. Achieve the improvements described in related action #5.				
H. Trade-Offs (Component 8) — State government should develop a Decision Support System (DSS) to provide guidance and leadership for defining uncertainties of future cost, benefits, prioritization, and other tradeoffs. The DSS would inform prioritization of State government expenditures, estimation of expected IWM benefits, and methods for apportioning costs across financiers. It also includes developing a clear and consistent methodology for identifying public benefits associated with the entire range of IWM activities.				

1 **Box 8-1 Elements of the Strategic Plan**

Element	Purpose
Vision	The vision statement describes the desired future for California water resources and management, and serves as a foundation for water and flood planning during the planning horizon.
Mission	The mission statement describes the California Water Plan's unique purpose and its overarching reason for existence. The plan identifies what needs to be done and why, and how Californians will benefit from the proposed actions.
Goals	The goals are the desired outcome of the water plan over its planning horizon. The goals are founded on the statewide vision. Meeting the goals requires coordination among federal, State, tribal, and local governments and agencies.
Guiding Principles	The guiding principles describe the core values and philosophies that dictate how to achieve the vision, mission, and goals. In other words, the guiding principles describe how to make decisions and do business.
Objectives	Each objective targets what needs to be done and why, to accomplish one or more goals.
Related Actions	Related actions tell how an objective will be carried out. They describe specific actions in measurable, time-based statements of intent. They emphasize the results of actions at the end of a specific time frame. Some related actions must be undertaken by State government or communities over whom the California Department of Water Resources has no authority. In these cases, performance measures and time frames must be part of the entities' own strategic plans.
Performance Measures	Performance measures describe what to measure and the method by which to measure, to determine what work was performed and what results were achieved. Performance measures may be short term, intermediate, or long term and can help with accountability and comparisons of how well an action has met a desired goal or objective.

Source: California Department of Water Resources 2011

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Box 8-2 Update 2013 Objectives

1. Strengthen Integrated Regional Water Management Planning.
2. Use and Reuse Water More Efficiently.
3. Expand Conjunctive Management of Multiple Supplies.
4. Protect and Restore Surface Water and Groundwater Quality.
5. Practice Environmental Stewardship.
6. Improve Flood Management Using an Integrated Water Management Approach.
7. Manage the Delta to Achieve the Coequal Goals for California.
8. Prepare Prevention, Response, and Recovery Plans.
9. Reduce the Carbon Footprint of Water Systems and Water Uses.
10. Improve Data, Analysis, and Decision-Support Tools.
11. Invest in Water Technology and Science.
12. Improve Tribal/State Relations and Natural Resources Management.
13. Ensure Equitable Distribution of Benefits.
14. Protect and Enhance Public Access to the State's Waterways, Lakes, and Beaches.
15. Strengthen Alignment of Land Use Planning and Integrated Water Management.
16. Strengthen Alignment of Government Processes and Tools.
17. Improve Integrated Water Management Finance Strategy and Investments.

Box 8-3 Delta Policy on the Coequal Goals

The policy of the State of California is to achieve the following objectives that the Legislature declares are inherent in the co-equal goals for management of the Delta:

- A. Manage the Delta's water and environmental resources and the water resources of the state over the long term.
- B. Protect and enhance the unique cultural, recreational, and agricultural values of the California Delta as an evolving place.
- C. Restore the Delta ecosystem, including its fisheries and wildlife, as the heart of a healthy estuary and wetland ecosystem.
- D. Promote statewide water conservation, water use efficiency, and sustainable water use.
- E. Improve water quality to protect human health and the environment consistent with achieving water quality objectives in the Delta.
- F. Improve the water conveyance system and expand statewide water storage.
- G. Reduce risks to people, property, and State interests in the Delta by effective emergency preparedness, appropriate land uses, and investments in flood protection.
- H. Establish a new governance structure with the authority, responsibility, accountability, scientific support, and adequate and secure funding to achieve these objectives.

Source: Water Code Section 85020

